

TOPSIS extension for multi-objective supplier selection problem under price breaks*

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Abstract. For supplier selection problem (SSP), if suppliers offer quantity discounts as well as buyer wants to buy multi-product, SSP becomes more complicated. In order to solve the complicated problem, an integration of TOPSIS approach and multi-objective mixed integer linear programming (MOMILP) is used to define the optimum quantities among the selected suppliers. In this article, we also apply TOPSIS approach to solve the MOMILP problem. In this solution, TOPSIS minimizes the measure of distance, providing that the closest solution should have the shortest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal solution (NIS) as well. Therefore, a q -dimensional objective space is reduced to a two-dimensional space (PIS and NIS). Finally, a single objective function is then proposed as a suitable one to resolve the conflict between the new criteria (the shortest distance from the PIS and the longest distance from the NIS).

Keywords: supplier selection, multi-product, quantity discount, TOPSIS, MOMILP

1 Introduction

Supplier selection is a multi-criteria decision-making (MCDM) problem that includes both quantitative and qualitative factors, some of which conflict to each other. In real case, there are two kinds of SSP. In the first type of the problem, only one supplier meets all the buyer's requirements (single sourcing), and in the second kind, multiple suppliers meet all the buyer's requests (multiple sourcing). Multiple sourcing needs the company to be more flexible. Despite the difficulty, it is very interesting when one of the suppliers, for reasons like price discount offers and possible limitations on quality, capacity, price, delivery and etc., cannot meet the assigned demand. For this problem, up to half of the researches are for situations where suppliers are selected for only one product, which various interdependencies that may exist among the different products are not considered^[4]. For instance, ordering and transportation costs may be minimized by combining orders for several products into one single order, and quality audits for different products could be executed at the same time as well. The different advantages of the synergy generated by the multiple products models are profitable for both buyer and supplier especially in the presence of quantity discounts^[4].

In quantity discounts context, which can be applied for both single and multi-product models, the sale amount of a product does not influence the discounts and prices of the other products. Several researches that have focused on multi-product quantity discounts^[4] are considered in this article. Stanley et al.^[17] used a modified form of the transportation problem to model bid evaluations for procurements at the US Department of Defense. The linear programming model was used to consider different forms of pricings including quantity

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