

An integrated approach for supplier selection and network design problem in a four-echelon supply network

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Abstract

In this paper a four-echelon supply network design problem is studied where decisions regarding selecting suppliers of raw materials, shipment quantity of each vendor to each plant, locating distribution centers (DCs) and allocating customers to DCs are to be made. An integrated fuzzy approach is designed to deal with this problem. The proposed approach answer the following questions: 1) which raw material supplier should be chosen, 2) what is the order quantity from each supplier for each product, 3) which locations for establishing DCs should be selected, and 4) how much product should be shipped from which open DC to which customer? In the first phase, in order to score and rank alternative suppliers, fuzzy Analytic Hierarchy Process (FAHP) and modified fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) has been applied. And, in the second phase, a multi-objective mixed integer linear programming (MOMILP) model is developed to answer the above questions, where three goals of 1) maximizing total value of purchasing (TVP), which is constructed by using suppliers' ratings calculated in the first phase, 2) minimizing total purchasing cost, and 3) minimizing total cost of locating DCs and distributing products in the network are taken into account. The compromise programming (CP) approach is adopted to deal with this multi-objective program. Finally, to show applicability and usefulness of the proposed approach, a numerical example along with sensitivity analysis has been carried out.

Keywords: Supplier selection; Order allocation; Location, Distribution, Supply Chain, Fuzzy sets

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