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A Bi-Objective Model for Determining an Optimal Warehouse Capacity, And Product Allocation in a Green Multi-Product, Multi-Period Distribution Network

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Abstract

Nowadays, the growing trend of environmental concerns is significantly higher than in the past while the business also focuses on the supply chain more to serve the customer demand using the lowest resources possible which leads to two main decisions which are capacity, and product allocation. Therefore, this research aims at designing a multi-product, multi-period, and multi-echelon supply chain network with factories, internal warehouses, external warehouses, and customers while also trying to lower the environmental effect of the supply chain through gas emission. For this problem, large data of products and 20 periods of planning horizon of a real-world polymer industry are considered. The product deliveries use direct shipment from both internal and external warehouses. We develop bi-objective mixed-integer linear programming to find the most optimal product allocation and capacity while minimizing the total logistic costs which include warehouse and transportation cost and total CO_2 emission through transportation. The problem is solved by the min-max approach through a Mixed integer linear programming model using CPLEX software. After we get the result, we compare it with the single-objective model's result to determine the trade-off between the total logistic cost and emission gas. Our base case result shows a better overall satisfaction level among all the models.

Keywords: Bi-objective programming, four-echelons supply chain, green supply chain, min-max approach, and Mixed-integer linear programming