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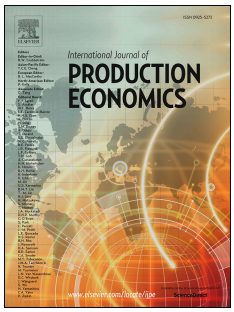

A two-stage supply chain problem with fixed costs: An ant colony optimization approach

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A Two-Stage Supply Chain Problem with Fixed Costs: An Ant Colony Optimization Approach

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Abstract

This paper focuses on a distribution-allocation problem in a two-stage supply chain with fixed costs. The problem is intended to determine a supply chain configuration of manufacturing plants, distributors, and retailers in the distribution network. The problem is formulated as an integer-programming model. The mathematical model incorporates unit transportation costs between entities and two types of fixed costs, including fixed cost for transportation routes and fixed cost for opening facilities. The objective of the model is to minimise the total costs of supply chain operation incurred in allocating the retailers to a distribution centre and the distribution centres to a manufacturing plant. An Ant Colony Optimization (ACO)-based heuristic is developed for solving the model. The heuristic is tested on various problem sizes generated. All the problem instances are solved using solver LINGO to evaluate the robustness of the ACO-based algorithm. The ACO-based heuristic emerges as a computationally efficient algorithm. Solutions can be obtained using the ACO-based heuristic within a reasonable computational time with a gap of about 10% on average from the optimal solutions.

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