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Optimization of a sustainable closed loop supply chain network design under uncertainty using multi-objective evolutionary algorithms

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ABSTRACT

Environmental, social and economic concerns have highlighted the importance of closed loop supply chain (CLSC) network design problem according to sustainable development. In addition, the uncertainty in decision elements adds to the complexity of this problem. Hence, this paper aims to propose a fuzzy multi-objective mixed integer linear programming (FMOMILP) model for a multi-echelon and multi-period CLSC network that minimize cost and environmental effects and maximize social impacts, simultaneously. At first, the model is converted into a multi-objective mixed-integer linear programming (MOMILP) model by the weighted average method. Due to NP-hardness of the problem, a non-dominated sorting genetic algorithm-II (NSGA-II) is developed to solve this multi-objective mathematical model. The obtained results are validated with the non-dominated ranking genetic algorithm (NRGA), due to there is no benchmark for this problem. In addition, different numerical instances are presented and analyzed with different measures in order to indicate the efficiency of proposed algorithms. The provided results demonstrate that the proposed NSGA-II algorithm is an adequate tool to solve the multi-objective problem of CLSC network design.

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