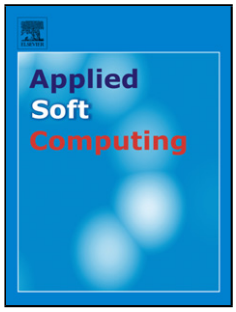

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A Bi-objective Optimization for Citrus Closed-Loop Supply Chain Using Pareto-Based Algorithms

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Highlights:

- A novel bi-objective optimization model for citrus closed-loop supply chain is proposed.
- A new version of multi objective Keshtel algorithm is developed.
- NSGA-II, NRGA, and MOSA are applied to validate the achieved results.
- A case study in Iran is employed as a test problem to verify the model.

Abstract:

Over the last two decades, many companies in developed countries have considered reverse logistics as an important process in their supply chain. This stem from the fact that useless materials may be worthwhile and they can re-enter in the supply chain with relatively minor modifications. Specifically, in case of citrus supply chains, the spoiled fruits in each echelon of the chain are one of the main concerns for decision makers in both private and public sectors. Therefore, this paper aims at minimizing costs of citrus closed-loop supply chain (CLSC) and maximizing responsiveness to customers' demand in each sector (forward and reverse). In order to achieve the research objectives, a new mathematical model for a citrus closed-loop supply chain is developed and also a multi-objective Keshtel algorithm (MOKA) is firstly proposed as a solution method. The proposed method is compared with the non-dominated sorting genetic algorithm (NSGA-II), the non-dominated ranking genetic algorithm (NRGA), and multi-objective simulated annealing (MOSA) to illustrate the performance of the proposed MOKA. In addition, a hybrid MCDM technique is proposed for selecting the best algorithm. In order to demonstrate the applicability of our study, a case study of a citrus closed-loop supply chain in northern Iran is presented. The results of the analysis and the case study show that the proposed model and solution method are promising.

Keywords: Closed-loop supply chain, Citrus reverse logistics, Bi-objective mathematical model, Multi-objective meta-heuristics.

1. Introduction

One of the complex issues that is needed to be decided on is the “returned products management” in both the strategic and operational levels. On the other hand, in large businesses, major strategic decisions often should be made through political parties and government; while operational decisions are made at lower levels such as municipalities. Hence, returned product managerial issues should be checked out by a variety of authorities in different locations [1]. Moreover, in today's developed countries, industry, government, and businesses pay an extra attention to reverse logistics and supply chain processes. They understand the value of these products and also their possible disadvantages the environment. Therefore, this concept plays an effective role in creating the more real value of economic goods and services with the support of environmental considerations [2].

Especially, reverse logistics (RL) is gaining ground in high-tech industries and agriculture sector. Kodak Company, as a disposable cameras manufacturer, can be exampled as a successful firm returning again the reclaimable part of the returned cameras such as boards, plastic parts and lenses to the production line after