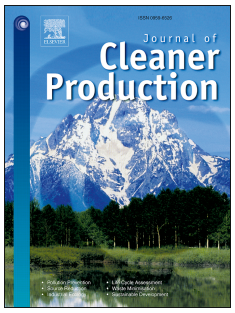
Accepted Manuscript



A robust fuzzy optimization model for carbon-efficient closed-loop supply chain network design problem: A numerical illustration in electronics industry

Mohammad Talaei, Babak Farhang Moghaddam, Mir Saman Pishvaee, Ali Bozorgi-Amiri, Sepideh Gholamnejad

PII: S0959-6526(15)01545-0

DOI: 10.1016/j.jclepro.2015.10.074

Reference: JCLP 6305

To appear in: *Journal of Cleaner Production*

Received Date: 25 October 2014

Revised Date: 17 October 2015

Accepted Date: 18 October 2015

Please cite this article as: Talaei M, Farhang Moghaddam B, Pishvaee MS, Bozorgi-Amiri A, Gholamnejad S, A robust fuzzy optimization model for carbon-efficient closed-loop supply chain network design problem: A numerical illustration in electronics industry, *Journal of Cleaner Production* (2015), doi: 10.1016/j.jclepro.2015.10.074.

A robust fuzzy optimization model for carbon-efficient closed-loop supply chain network design problem: a numerical illustration in electronics industry

Mohammad Talaei[1], Babak Farhang Moghaddam[2], Mir Saman Pishvaee[3], Ali Bozorgi-Amiri[4] and Sepideh Gholamnejad[5]

1. Industrial Engineering Group, College of Engineering, Islamic Azad University, Parand Branch, Tehran, Iran.
moha.talaei@gmail.com
2. Institute for Management and Planning Studies, Tehran, Iran.
farhang@iust.ac.ir
3. School of Industrial Engineering, Iran University of Science and Technology, Tehran, Iran.
pishvaee@iust.ac.ir
4. School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran.
alibozorgi@ut.ac.ir
5. Department of Economics, Allameh Tabatabai University, Tehran, Iran.
sepideh.gholamnejad@gmail.com

Corresponding Author: Ali Bozorgi-Amiri
E-mail: alibozorgi@ut.ac.ir
Phone: (+98)2182084484

ABSTRACT

Environmentalism has become an important global issue in the present century. During the recent years, the closed-loop green supply chain management has been increasingly a center of attention as a result of governmental laws and legislations (regarding the environmental effects of any activity) and the soaring consumers' expectations. In this study, effort has been made to investigate a facility location/allocation model for a multi-product closed-loop green supply chain network consisting of manufacturing/remanufacturing and collection/inspection centers as well as disposal center and markets. To design the network, we have proposed a mixed-integer linear programming model capable of reducing the network total costs. The model has been so developed as to consider such environmental objectives as reducing the rate of carbon dioxide emission in the environment throughout the network in question. Moreover, the model has been developed using a robust fuzzy programming approach to investigate the effects of uncertainties of the variable costs, as well as the demand rate, on the network design. To solve the bi-objective programming model, use has been made of the ε-constraint approach and a numerical illustration of Copiers Industry is used to show the applicability of the proposed optimization model. Results have revealed that the model is capable of controlling the network uncertainties as a result of which a robustness price will be imposed on the system.

Keywords: Closed-loop green supply chain network, Facility location, Carbon dioxide emission, chance constrained fuzzy programming, Robust optimization