A Mathematical Modelling Approach for a Sustainable Closed Loop Supply Chain Network Design

Nusrat Tarin Chowdhury
Assistant Professor, School of Technology, Art, and Design
College of Arts, Education, and Humanities
Bemidji State University
Bemidji, MN, USA
nusrat.chowdhury@bemidjistate.edu

Abstract

Due to increasing concern of environmental degradation by various supply chain activities such as sourcing, transportation, inventory holding, manufacturing, and distribution, industries have begun redesigning their supply chain network to integrate recycling and reuse of product returns. The combination of the forward movement of goods from raw materials to the end user and the reverse movement of goods from the end user to the manufacturer, or even back into raw materials through recycling is entitled as Closed Loop Supply Chains (CLSC). In this paper a multi objective Mixed Integer Linear Programming (MILP) model is developed to determine the optimal locations of the facilities and the distribution of flows between the facilities in the CLSC. The sustainability goals addressed in this research include minimizing cost (economic goal), minimizing carbon emission (environment goal) and maximizing the employment (social goal). The proposed MILP has been validated using a randomly generated data set.

Keywords
Closed Loop Supply Chains, Mixed Integer Linear Programming, Sustainability, Carbon emission, social goal.

Biography
Nusrat T. Chowdhury is an Assistant Professor, in the School of Technology, Art and Design at the Bemidji State University Minnesota, USA. She earned her bachelor's and Master's in Industrial and Production Engineering from Bangladesh University of Engineering and Technology, Bangladesh, and PhD in Industrial and Manufacturing System Engineering from University of Windsor, Ontario, Canada. Her research interest is in the areas of Supply Chain and Inventory Management, Computer Aided Process Planning (CAPP), Operations Research, and Computational Complexity.