A Mixed Integer Nonlinear Model for Closed-Loop Supply Chains with Incentive and Proximity based Product Returns

C. Sy*¹, A. Yamzon², P. Guico², V. Ventura²

¹DLSU, Philippines
²De La Salle University, Philippines

Abstract

Electronics firms in different locations are being required to collect used products due to environmental and health hazards. In order to meet environmental requirements, firms carry out collection activities and provide incentive offers to attract product returns. A mixed integer non-linear programming model for a Closed-Loop Supply Chain including decisions for collection activities, incentive offers and recovery options is formulated and validated. Quantity is modeled as a function of incentive offers and distance between the collection centers (distribution/retail centers) and consumers. Meanwhile, quality of product returns follows an arbitrary probability distribution, which is shifted by incentive level. Quality of product returns dictates the possible recovery options, which these can undergo. The model is subjected to scenario analysis. This is comprised of conditions wherein rebate, or discount incentives is preferred and when low or high incentive levels are favored. High stockout cost to secondary consumers encouraged the model to perform more cash rebate activities to stimulate more product returns to satisfy secondary consumer demand. In another situation, high cost of activities while having high stockout cost to secondary consumers induced the model to carryout discount activities as this would generate sales rather than the cash rebate which simply incentivizes the participation in the takeback program.