

Design of Multipurpose Sustainable Network Model for Reverse Logistics: A Multi-Objective Optimization Approach

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Abstract: This paper will focus on the design reverse-forward logistics framework that finds an optimal tradeoff of multi-objective such as cost, revenue, and delivery time. Traditional models addressed forward, reverse, or both but same products usually returned or defective products. However, in this model reverse logistics mean flow of different products in forward and reverse direction. In forward flow suppliers in country supplies product type A to the customers in other countries and same containers return to the origin destination carrying product type B. The ultimate benefit of reverse forward flow is to ensure minimum cost, maximum revenue, and delivery in shortest span of time. This research comprises of three stages, in first stage, a multi-objective (MILP) Mixed Integer linear programming model is developed. The multiple objectives are total cost of transportation of finished goods, Total time to shipment, and total cost of transportation of returns. To solve the multi-objective optimization, an interactive multi-objective fuzzy programming is introduced in the second phase. The proposed methodology incorporates the expert opinion using fuzzy numbers and measure the quality of objective solution through satisfaction level. Interactive multi objective fuzzy programming aggregates all objectives into a single objective using experts' weights and satisfaction level from payoff values of conflicting objectives. In third phase, a case study of KSA and China for reverse/forward logistic flow will be presented as a practical application of proposed model. The optimal decision of model will include number of containers and ships needed in reverse and forward flow that would minimize cost, maximize revenue, and timely products delivery. This case study will also consider alternative routing such as Arabian sea and CPEC corridor between china and Pakistan. The expected results will be useful for the business and logistics manager to design their shipment plans for getting advantages of reverse and forward flow of containers and ships.

Keywords: *Reverse/forward logistics; Cost; Revenue; Delivery; Interactive multi objective fuzzy programing; CPEC; alternative routes.*