Green Supply Chain Design: A Mathematical Modeling Approach

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Abstract : Green Supply Chain Management (GSCM) is becoming a key to success for profitable businesses. The various activities contributing to carbon emissions in a supply chain are transportation, ordering and holding of inventory. This research work develops a mixed-integer nonlinear programming (MINLP) model that considers the scenario of a supply chain with multiple periods, multiple products and multiple suppliers. The model assumes that the demand is deterministic, the buyer has a limited storage space in each period, the buyer is responsible for the transportation cost, a supplier-dependent ordering cost applies for each period in which an order is placed on a supplier and inventory shortage is permissible. The model provides an optimal decision regarding what products to order, in what quantities, with which suppliers, and in which periods in order to maximize the profit. For the purpose of evaluating the carbon emissions, three different carbon regulating policies i.e., carbon cap-and-trade, the strict cap on carbon emission and carbon tax on emissions, have been considered. The proposed MINLP has been validated using a randomly generated data set.

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