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Four-level closed loop supply chain with remanufacturing

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Abstract

This paper addresses the coordination of order quantities in a four-level closed-loop supply chain (CLSC) with remanufacturing. The levels are multiple buyers and tier-1 and tier-2 suppliers, and a manufacturer. The reverse channel consists of an inspection and disassembly center and a remanufacturing center. Customer demand is met from either newly manufactured items, remanufacturing used items collected from customers for recovery, or from both. Mathematical models are developed to find the production (manufacturing and remanufacturing) and inventory policies that minimize the CLSC total cost. One of the models considers emissions from production and transportation and accounts for energy usage. The results showed that higher collection rates of used items reduce the supply chain costs and improves its environmental performance. A mixed strategy of manufacturing and remanufacturing was found to be best for the chain.

Keywords: Closed-loop supply chain; reverse logistics; inventory management; coordination; environmental issues.

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