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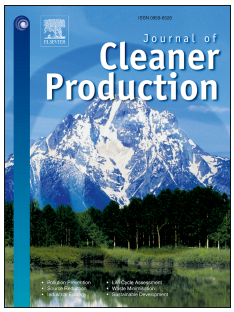

Pricing, product quality, and collection optimization in a decentralized closed-loop supply chain with different channel structures: Game theoretical approach

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Pricing, product quality, and collection optimization in a decentralized closed-loop supply chain with different channel structures: Game theoretical approach

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Abstract In recent years, recycling and remanufacturing functions have received increased attention because of strict environmental concerns and regulations. The aim of this paper is to investigate the pricing strategies as well as the quality level and effort decisions of the manufacturer, retailer, and third party operating in two types of closed-loop supply chains: (1) single-channel forward supply chain with a dual-recycling channel (SD model) and (2) dual-channel forward supply chain with a dual-recycling channel (DD model). On the basis of these different channel structures, two manufacturer Stackelberg game models are developed to explore the best values for prices, quality levels, and sales and collection efforts. In addition, to draw managerial insights, corresponding equilibrium solutions of the two model structures are determined and compared, and the channel structure that most benefits each supply chain member is examined. To reduce channel conflicts and increase each channel member' profits, a novel coordination mechanism is introduced and discussed. Two numerical examples are presented to simulate the strategies for choosing the best channel format for a decentralized closed-loop supply chain and examine the effectiveness of the coordination contract. The results revealed that the DD model is the best for the manufacturer, and the optimal channel structure for the retailer depends on the retailer's market share. However, by applying a novel coordination mechanism, all three members of a closed-loop supply chain can benefit from the introduction of an online selling channel. Furthermore, the results showed that the quality of products in the DD model is always greater than it is for products in the SD model. Moreover, it is observed from the sensitivity analysis that the recycling channel member with a predominant market share exerts greater collections effort and offers lower buyback prices than others in the collection channel.

Keywords: Closed-loop supply chain; Dual-channel supply chain; Return policy; Sales and collection effort; Dual recycling channel.

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