Department of Systems Science and Industrial Engineering
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Thesis Defense Announcement

Analysis of Profitability and Remanufacturing Market Share of a Closed-Loop Supply Chain: A Discrete-Event Simulation Approach

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Abstract

In recent years, closed-loop supply chains (CLSCs) have received more attention due to increased public and governmental awareness on environmental issues. Thousands of tons of mobile phone waste accumulate each year, indicating an urgent need in remanufacturing of materials in the smartphone industry.

This research presents a simulation study on three aspects of a CLSC: circular economy, reverse logistics, and remanufacturing. In particular, the study focuses on five factors that originate from these aspects: channel leadership, product quality, demand levels, pricing policy, and inventory management. There are three channel leaderships for reverse logistics: manufacturer, retailer, and remanufacturer. Product quality has three levels (high, medium and low). Demand is evaluated at two levels (high and low). For pricing policy, each participant of the CLSC charges a high, medium or low price for their products. For inventory management, the reorder point and order-up-to quantity are considered at two levels (high and low) for both the manufacturer and retailer. A total of 288 (2x3x3x16) scenarios are investigated in the simulation study. The scenarios are evaluated based on two performance measures: net profits (for the
The results indicate that retailer-led and remanufacturer-led reverse logistics are the most profitable CLSCs, whereas manufacturer-led reverse logistics are the least profitable CLSCs. High-quality products in retailer-led reverse logistics result in the highest net profit for the overall CLSC and for the retailer. On the other hand, high-quality products in remanufacturer-led reverse logistics result in the highest net profit for the manufacturer. Medium-quality products result in higher net profit and market share for the remanufacturer, when compared to high-quality and low-quality products. A high order-up-to quantity placed by the manufacturer increases the remanufacturer’s market share by up to 6.8%, when compared to a low order-up-to quantity placed by the manufacturer. The findings from this research suggest that retailer-led and remanufacturer-led reverse logistics can be an opportunity for high-end and mid-range smartphone manufacturers, respectively. This research work can be extended to explore cooperation between the remanufacturer, retailer, and manufacturer in the CLSC, recollection effort policies, and dynamic pricing studies.