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Abstract

This paper analyses the inventory and order flow dynamics in closed-loop supply chains (CLSCs). In this kind of supply chains the reverse flow of materials entering the system for recycling purposes complicates the way in which inventories should be managed and replenishment policies should be designed. Specifically, we analyse the relationships between some reverse logistics' factors (remanufacturing lead-time, return rate of recycled products, reverse order policy, and number of supply chain tiers) on the order and inventory variance amplification. We firstly perform a systematic literature review of the related studies. Secondly, by adopting a difference equation math approach and design of experiment we perform a robust what-if analysis of a CLSC under a variety of operational and market conditions. Results show that, ceteris paribus, CLSC outperforms a forward supply chain, both in mono-echelon and multi-echelon structures and under both stationary and turbulent market demands. Furthermore, reducing remanufacturing lead-time and promoting information transparency may be crucial to improve CLSC dynamics. Finally, we use the research findings to provide interesting managerial consideration about how to reduce unnecessary operational members' costs.

Keywords: Supply chain dynamics, reverse logistics, remanufacturing lead time, bullwhip effect, systematic literature review, simulation.

1. INTRODUCTION

Sustainable Supply Chain refers to the management of material flows, information and funds, as well as cooperation between firms along the supply chain (SC) that simultaneously consider the three dimensions of sustainable development: environmental, social and economic (Brandenburg et al. 2014, Meixell and Luoman 2015, Eskandarpour 2015). A firm can use a sustainable program as a strategic tool not only for environmental