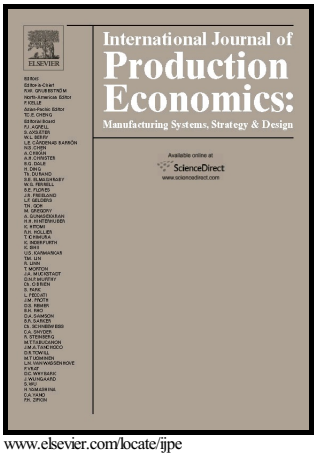

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Minimization of disruption-related return flows in the supply chain

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Abstract

Recent research on closed-loop supply chains (SC) and reverse logistics extensively emphasises the crucial role of reducing negative return flows such as emissions, waste, etc. In this study, we consider the return flows in the SC in light disruptive events in the SC. The objective of this study is to compare the performance impact of different recovery policies on return flows subject to the simultaneously optimized re-configuration plans for material flows. We formulate a multi-objective problem with return flow reduction function for a multi-period, multi-stage, multi-product SC. We consider a recovery problem with ripple effect, performance impact assessment and re-planning decisions. The developed multi-objective hybrid linear programming-system dynamics model allows simultaneously re-computing the material flows in a multi-stage SC after a disruption and comparing the performance impact of different recovery policies subject to return flows, gradual capacity recovery, variable recovery costs and time. The results suggest that the consideration of gradual capacity recovery leads to minimization of disruption-related return flows in both upstream and downstream SC parts. Fast and expensive recovery strategy provides the lowest return costs in the upstream SC part as compared to normal and slow recovery policies. Similar, the profits and service levels are increased. In the fast and expensive recovery policy, the performance in the upstream and downstream does not change with the introduction of the gradual recovery considerations. The effects of gradual capacity recovery introduction become evident if smaller time sub-periods are considered within the recovery period.

Keywords: supply chain, return flows, disruptions, recovery, ripple effect