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Relation between lead time dependent demand and capacity flexibility in a two-stage supply chain with lost sales

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Abstract

Supply chain literature shows that speed of delivery, or equivalently provided delivery lead time, is a crucial performance factor and influences the expected customer demand. However, short delivery lead times imply stochastic demand peaks, for which production economics literature indicates that flexible capacity can be applied to mitigate their negative effects. In this paper a two stage supply chain with flexible capacity at the supplier and lead time dependent demand at the customer is investigated. Specifically, the random customer demand depends on the delivery lead time provided by the supplier and demand which cannot be fulfilled is lost. An analytical model is developed which includes predefined steady capacity and a demand dependent decision for flexible capacity. The trade-off between lost sales due to the provided delivery lead time, lost sales due to a lack of capacity, inventory cost and the cost for flexible capacity is discussed. Numerical results indicate that high capacity flexibility is needed if lost sales cost, demand variance, or customer lead time sensitivity is high. Furthermore, the positive effect of information sharing within the supply chain is evaluated.

Keywords: lead time dependent demand, capacity flexibility, lost sales model, supply chain, stochastic model.

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