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Impacts of carbon emission reduction mechanisms on uncertain make-to-order manufacturing

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Abstract

Lot sizing in queuing networks is pivotal to batch manufacturing, especially in stochastic environments. Despite development in lot sizing optimisation, the results are often rendered unrealistic because few studies have considered the impacts of relevant environmental regulation policies on production planning. This paper incorporates stochastic lot sizing optimisation with two dominant carbon emission reduction mechanisms – the carbon emission constraint and the cap-and-trade system – to examine their operational and environmental impacts on make-to-order manufacturing. It also compares these two mechanisms in environmental conservation. Numerical experiments validate the importance of considering the carbon emission regulations to traditional production planning problems. The results highlight that the market-based characteristics of the cap-and-trade mechanism motivate firms with economic benefits

to adopt low-carbon technologies and environmental-friendly facilities to curb greenhouse gases emission. In contrast, the carbon emission constraint mechanism is like administrative orders to force out outmoded industries and outdated technologies.

Keywords:

lot sizing | stochastic methods | make-to-order | production planning | emission constraint | cap-and-trade

Disclosure statement

No potential conflict of interest was reported by the authors.