AN INTEGRATED INVENTORY-LOCATION MODEL FOR A SUPPLY CHAIN UNDER STOCHASTIC DEMAND AND LEAD TIME

M. Fathi, D. Claeys, and H. Bruneel

SMACS Research Group, Department TELIN
Ghent University
`{mfathi,dclaeys,hb}@telin.ugent.be`

Abstract

We develop an optimization model for a supply chain, integrating both location and inventory decision making. The supply chain consists of one supplier, multiple distribution centers and multiple retailers, and is subject to stochastic customer demand and supply lead times. The objective is to simultaneously optimize the locations of distribution centers and their stock levels. First, the stock level of a distribution center is modelled as a Markov chain of which the long-run time average is obtained. Then, a cost function is proposed that incorporates the holding costs, as well as travel costs and lost sales.

Minimizing the cost function is cumbersome: not only is the cost function discrete and non-linear, but also the number of decision variables is substantial. As a result, the optimization problem becomes computationally challenging and eventually even infeasible for traditional solvers when the number of potential locations for distribution centers increases. Therefore, we develop a genetic algorithm. Experiments indicate that this algorithm is computationally tractable while yielding satisfactory results.

Keywords: Supply chain management, Location-inventory model, discrete non-linear optimization, stochastic demand, stochastic lead time, genetic algorithm