Investigation of Feasible VMI Strategies for a Two-Echelon Supply Chain with Variable Demands and Multi-Period Replenishment Planning Horizon

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Abstract

The vender-managed inventory (VMI) problem involves with the coordinating planning and decision of inventory replenishment and delivery. As the scale of a supply chain increases the advantage of VMI might be downgraded due to an embedded large scale of inventory distribution problem, which was defined as an Inventory Routing Problem (IRP). The inventory control strategy used by the supplier had been considered as one vital factor to complicate the IRP. However, less attention has been paid in the study of its effect on the cost combinations of the IRP not to mention that the issue would be made complicated by multiple or infinite review periods. This study proposes new VMI strategies and investigates their effects on the related cost components of the IRP and the trade-off effect between inventory and transportation cost for a multi-period IRP with variable demands especially for practical implementation. An event simulation model constructed by using Arena along with the integer programming method are used to perform the inventory control process and resolve the inventory delivery task. Analysis results from simulation scenarios constituted by different combinations of VMI strategies with deterministic and stochastic customer demands under multi-period planning horizon indicate the proposed VMI strategies could increase the total number of retailers receive replenishment and delivery as well as the efficiency of vehicle utilization, which are feasible for practical applications.

Keyword：VMI strategy, Multi-Period IRP, Replenishment, Stochastic Demand, Event Simulation, Arena.