SEMINAR SERIES
Department of Quantitative Analysis and Operations Management
College of Business Administration
University of Cincinnati

Comparison of Base Stock Policies for Acyclic Multi-Echelon Networks

Ton G. de Kok
Department of Technology Management
Eindhoven University of Technology
Eindhoven, The Netherlands

Friday May 7, 1999
12:30 p.m.
214 Lindner Hall

In this paper we discuss the analysis of acyclic multi-echelon networks. Acyclic multi-echelon networks can be characterized by *N* items that have parent-child relation ships, i.e. for each item it is given into which items it is assembled. From these gozinto-relations one can derive for each end-product its Bill Of Material. For acyclic multi-echelon networks the gozinto-relations for each item must be such that an item cannot be part of itself either directly or indirectly. Most practical BOM structures satisfy this constraint, except for BOM structures with return flows of (by)-products. We assume that no fixed costs are incurred for ordering items. We assume that items are ordered periodically with the same period for all items. Thus we use base stock policies for ordering items, i.e. at the beginning of each period an amount is ordered such that the echelon inventory position of an item is raised to its target or base level. The echelon inventory position consist of items on order, items on stock plus all items downstream of the item stockpoint assembled into other items. For the control of such acyclic networks it is not clear what the structure of the optimal policy is like. Especially the issue of shortages of items needed for release of an order for a particular item causes a major complexity. Therefore several heuristic rules are considered. The paper focuses on comparison of a so-called pre-allocation scheme developed in an earlier paper by the author and a allocation scheme developed by Agrawal and Cohen. The latter allocation policy allocates shortages of an item to items in need of this item according to the period demand ratios. The amounts of items that are allocated to a particular item order are consigned to this order, even if the order cannot be completely satisfied in case of lack of other items. The first allocation scheme is based on a decomposition of the acyclic network into a (number of) divergent network(s). Using the divergent network representation it is straightforward to derive the orders released and the allocation of items to other items. The decomposition is in static, so that the allocation does not exploit the latest information about demand as is the case with the consignment allocation policy. We compare the two approaches and try to identify under which circumstances one base stock policy is preferred over the other. The comparison is based both on analytical results and simulation.