Optimal Supply Chain Operation – A Discrete Model Formulation

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Abstract
The competitive pressure and market globalisation as well as the relation between price, quality and product lifetime are some major factors that underline the need for new planning policies that can handle global supply chain structures and dynamics so as to improve the desired economical and operational performances.

In this paper a new framework is developed for the operation of industrial supply chains. This allows the integration of different topological, operational and processing pre-conditions constraints into a single level formulation. The proposed model relies on the discretization of time horizon into intervals of equal duration and results from the linkage between the maximal State-task Network, \( mSTN \) and the Flowpaths representations (Barbosa-Póvoa, 1994, PhD Thesis Imperial College; Amaro and Barbosa-Póvoa, 1999, EJOR, 199, 461-478) adapted to the supply chain characteristics. Supply chain structural and dynamic characteristics are studied. In the former aspects such as suppliers, plants, distribution centres, storage and transportation facilities - network structure – are modelled while in the later operating policies and production, storage, distribution or transportation requirements are considered. Also, possible operational pre-conditions within the products production as well as market considerations presented in the supply-demand relations are accounted for.

Based on these characteristics a Mixed Integer Linear Programming (MILP), formulation is obtained and solved using standard Branch and Bound (B & B) procedures.

A detailed operational plan is obtained where not only transportation aspects are considered but also production and storage considerations are included within the supply chain so as optimise a pre-defined economical or operational performance criteria.

Finally, the flexibility and applicability of the new formulation to the scheduling of supply chain structures is illustrated through of a case-study.

Keywords: Supply Chains, Operation, Transport, Optimization, Pre-conditions.

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