Supply Chain Design Considering Operational Level Details

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One important challenge in Supply Chain Management (SCM) and Enterprise Wide Optimization (EWO) is the decision making coordination and integration at all hierarchical levels. It has been demonstrated that significant Supply Chain (SC) performance improvement can be gained by achieving such integration. Most models developed so far address separately the issues raised in the three hierarchical levels of decision of the SC (i.e. strategic network design, tactical aggregated planning and short- term scheduling). Some models have already considered the integration of SC design and planning (Kallrath, 2002). Some others have focused on the integration of planning and scheduling decisions (Karimi and McDonald, 1997; Zhu and Majozi, 2001). However, an interesting problem still calling for further research is the integration and assessment of SC design decisions in the detailed operations scheduling. This issue has been obviated mainly because of the complexity resulting from the consideration of the different timescales contemplated in its formulation. The strategic level utilizes aggregated capacity and production figures which are essential for the operations planning and detailed scheduling decision levels. However, infeasibilities may appear at the detailed short-term scheduling model which uses disaggregate production and capacity values required by the consideration of changeover times, sequencing decisions, cleaning times, etc. Such infeasibilities lead to unsatisfied demand, deviations from previous strategic plans and consequently inferior overall SC performance.

In this paper we apply attainable region approach to the integration of SC hierarchical levels. The main idea behind this kind of framework is to find a new set of constraints that adequately represent the scheduling constraints (Sung and Maravelias, 2007). This new set of constraints is formulated using the production rates and the design variable representing whether an equipment technology is installed or not. Then, this set of constraints is added to the design-planning problem in order to integrate the SC hierarchical decision levels. Validation of the proposed approach and resulting potential benefits are highlighted through a case study. Moreover, the results obtained of this particular case study are examined and discussed towards future work.

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