Chapter 18

VISUAL REPRESENTATION OF MATERIAL FLOWS IN CHEMICAL PLANT SYSTEMS
An approach based on SCHEDULE++

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Abstract: This chapter discusses the utilisation of software add-ons like SCHEDULE++ for the supply chain manager, production planner and material requirements planning controller. Using this tool, the flow of material can be tracked over several production and storage facilities of chemical plants. Moreover, supply chain tree and dynamic pegging data for material production and material consumption can be gathered. It will be shown, how consequences of changes in raw material delivery, changes to customer orders, or machine breakdowns can be visualised along the supply chain. A recursive algorithm was developed for dynamic pegging over the whole supply chain. We also discuss how such software applications can be used together with the SAP R/3 system.

Key words: supply chain, production planning, recursive algorithm.

1. INTRODUCTION

This chapter will describe production planning in a system of chemical plants using standard Production Planning (PP) systems. A planning situation in a PP system is characterised by plant stocks (factory inventory), planned orders, process orders, purchase orders, purchase requisitions, which are planned independently of customer orders. There may be several kinds of breakdowns for a planning situation. The following situations will be considered in this scenario:
1. A delivery of raw material is delayed (i.e., a purchase order or purchase requisition has to be changed).
2. There is a machine breakdown (i.e., process orders, which are assigned to the machine must be deleted or assigned to another machine).
3. One of several competing process orders on a bottleneck resource has to be selected by taking into account the effect on the whole supply chain.

4. A customer order has to be shifted (to an earlier or later date) or cancelled.

All of the above situations lead to the desire to see the effects on all the plants in the supply chain (SC). In the first case one would like to know, which process orders are affected and which customer orders cannot be delivered on time. In the second scenario (similar to the case 1), the breakdown leads to material unavailability, and the effects on subsequent steps have to be taken into account. The decision in the third example has to be made under consideration of the dependant customer orders, with respect to their delivery dates and strategic significance. In the fourth case, capacities can be freed and raw material purchase can be reduced. If all of these corollaries can not be considered, promises to customers cannot be kept or the stock levels will increase.

The chapter is organized as follows. In Section 2 the problem will be specified in detail. The solution approach is briefly described in Section 3. Section 4 contains descriptions of the main components of the SCHEDULE++ software add-on to SAP R/3. The algorithm for constructing a tree of the material flow in a system of plants is described in Section 5.

2. PROBLEM SPECIFICATION

Material requirements planning (MRP) or consumption-based planning can be used as the materials planning procedure for resolving the conflicts described above. MRP tries to optimise the following possibly competing goals: Optimising the service level, minimising costs and capital lockup. The main role of MRP is to monitor stocks, i.e., to generate order proposals for purchase and production (planned orders, purchase requisitions, or delivery schedules). Standard PP systems provide MRP runs, but sometimes an MRP run can result in invalid plans with capacity conflicts on resources. In addition, the requirements planning in chemical multi-purpose plants often consists of merging a large number of Microsoft Excel sheets, so that the whole current planning situation often remains unclear.

Planning that spans multiple plants may also be desirable. Unfortunately, planning processes in chemical multi-purpose plants are usually organised in the form of anonymous make-to-stock manufacturing. Therefore there are no data structures representing links in the supply chain. Moreover, these data structures are often not even