Revising the Master Production Schedule in Sequence Dependent Processes
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Citation: International Journal of Production Research, 41 (9), 2003, 2021-2035

Past MPS research has generally not focused on environments with sequence dependent changeover times, as is common in process industries. This paper presents two heuristics to revise the MPS to improve plant performance in such environments and uses simulation to investigate the sensitivity of the performance effects to frequently encountered plant operating conditions.

Experimental factors consisted of the amount of variation in the changeover times, time between orders, level of demand uncertainty, replanning frequency, and the heuristic used to revise the MPS after a standard MPS update has already taken place. Both heuristics focus on reducing total changeover time, but the “local” heuristic only potentially swaps adjacent orders, whereas the “global” heuristic considers three-way interchanges throughout the horizon. While reduction in total changeover times is important because it facilitates increased capacity and thus increases flexibility to respond to demand variability, that metric must also be compared against the total amount of finished goods inventory that is held and the shortages that occur over the horizon because of the resequencing of orders.

Although simulation demonstrated that both heuristics achieve their primary goal of reducing total setup times, the effects of each heuristic on the other performance measures are mixed and sometimes dependent on the other experimental settings. Although the global heuristic results in the most improvement in changeover time, it also causes far more inventory to be held due to its ability to move orders throughout the planning horizon; the local heuristic does not show nearly as great of an inventory penalty. While frequent replanning aids the heuristics in achieving total setup time reduction, it decreases the improvement in shortages that both heuristics generally show (to the point where very frequent replanning results in worse shortages compared to when a heuristic is not used), and the increase in inventory held when using the global heuristic is even more common with increased replanning. Environments characterized by high variation in changeover times and low time between orders can achieve particularly large improvements in both changeover times and shortages when using the local heuristic.

In summary, significant benefits are possible by utilizing heuristics in environments where there are sequence dependent changeover times, but potential performance tradeoffs need to be weighed in light of the operating characteristics.