OPTIMAL CONTRACT APPRAISAL FOR CONTRACT MANUFACTURING ORGANISATIONS IN THE PHARMACEUTICAL INDUSTRY

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ABSTRACT

Over the last two decades, large pharmaceutical companies have increasingly outsourced part of their activities, such as manufacturing, to Contract Manufacturing Organisations (CMOs). CMOs are companies without their own product portfolio, and they focus on producing products of other companies. This policy enables R&D multinationals to reduce costs and to emphasise on the most important activities such as drug discovery and marketing, which constitute the key parts of their value chain. Usually, drug development is a time-consuming process, as it takes more than 10 years on average to develop a new medicine. Additionally, demand of newly developed pharmaceutical products is usually characterized as highly volatile, since a lower drug efficacy can decrease the demand and the total sales. In the worst case, unexpected side effects can lead to the suspension or even the withdrawal of the drug. Under this dynamic environment, a CMO must decide the best contract combination to accept by considering the maximization of its profits and its tolerance to risk (Marques et al., 2020).

In this work, an integrated planning and scheduling framework is proposed for the optimal contract selection problem of CMOs, under uncertainty. Considering a multistage batch facility of a secondary pharmaceutical process industry, an aggregated MILP planning model is firstly proposed including material balances and allocation constraints. Utilizing a rolling horizon approach, the production targets are provided to a precedence-based MILP scheduling model to define batch-sizing and sequencing decisions in detail. A feedback loop is also integrated to converge production targets among the planning and scheduling decision levels. To model the product demand uncertainty a scenario-based approach is proposed, considering the Conditional Value-at-risk measure. Since large number of scenarios increases significantly the complexity, a scenario reduction framework is incorporated to decrease the total solution time when considering large-scale problem instances (Li and Floudas, 2014). The proposed methodology can increase the profitability of CMOs and could potentially constitute the main core of a computer-aided tool that allows CMOs to select the optimal contract combination, depending on their risk tolerance.

KEYWORDS: Contract Manufacturing Organizations, Conditional Value-at-Risk, MILP, Planning Optimization

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