

Facilitating New Product Introductions in Pharmaceutical Plants via Optimized Planning and Outsourcing

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High product turnover is crucial to the continued economic survival and growth of a pharmaceutical company. Pharmaceutical companies routinely introduce new products in order to revive their business with the early profits. The need and decisions to introduce new products early to the market and the uncertainties inherent in the development processes necessitated much research to focus on the product pipeline management problem involving the selection and scheduling of product development tasks. An issue that relates to this and the one that a pharmaceutical plant times and again needs to resolve is whether it can or should undertake to produce a new intermediate or product, or should outsource some tasks to enable it to do so. The disruptions that occur in the production of existing products, when new products enter the production phase and various trade-offs involved in the introduction of new product in a given plant remain to be scrutinized. Often, the management may outsource production of some intermediates or legacy products to make room for the new products. However, a systematic analysis of the planning and outsourcing issues that relate to new product introductions is absent in the literature. In this paper, we present a multi-period, continuous-time, mixed-integer linear programming model that addresses this important problem for the pharmaceutical plant using multiple parallel production lines in campaign mode, and producing products with multiple intermediates.

Whether it is profitable or even feasible to introduce a new product at a given facility is a routine but crucial decision for a pharmaceutical company. To address this, we consider pharmaceutical plants operating in campaign mode. We develop a model to evaluate in detail the operational and financial effects of new product introductions at such plants. We also address how outsourcing of existing products can lessen these effects and thus make the introduction of high-margin new products more attractive. In other words, we specifically address the supply chain dynamics at the plant level as they relate to the new product introductions in a pharmaceutical plant, and optimize the production, inventory, and outsourcing decisions to maximize gross profit.

In this work, we focus on the planning of one primary multiplant production site F that consumes raw materials, produces and/or outsources intermediates and active ingredients (AIs), maintains necessary inventories, and supplies AIs to secondary production sites. Given a set of due dates, demands of products at these due dates, several operational and cleaning requirements, the aim is to decide the optimal production levels of various intermediates (new and old) and the optimal outsourcing policy to maximize the overall gross profit for the plant, while considering in detail the sequencing and timing of campaigns and material inventories. We present a few examples to illustrate the effects of new product introductions on plant production plans and the benefits of outsourcing. We attempt to answer questions such as how to accommodate new products, when the production of existing products is already tight, and several other what-if scenarios germane to the production of new products.

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