Assessing and Accelerating New Product Introductions in a Pharmaceutical Plant

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Global competition requires every pharmaceutical company to enhance its economic performance. High product turnover is crucial to the continued economic survival and growth of a pharmaceutical company. Pharmaceutical companies aspire to introduce new products in order to revive their business with the early profits. Hence, the time to market and the quick reap of the profits from the new products before their shortened life cycles are the keys to the success of these companies.

New product introductions involve two major phases: Product Development (conceptualization, design, promotion, and pricing) and Product Launch (physical positioning in the market via commercial production). Product launch phase consume a significant amount of total new product costs, often exceeding the combined expenditures in all previous development stages[1]. Launch phase includes identifying the right place to market, right production site to produce, and optimizing the planning and scheduling of the production of new products. Mistakes, miscalculations, and oversights in any of these product launch activities can become fatal obstacles to new product success. Hence, the optimal planning of new product introductions into the appropriate production sites so as to target the right market is of paramount importance to any pharmaceutical company.

Whether it is profitable or even feasible to introduce a new product at a given facility is often a challenging decision to be made by 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. 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 supply decisions to maximize gross profit. Moreover, we analyze 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. In this paper, we present a multi-period, continuous-time, mixed-integer linear programming model that addresses the above issues for a pharmaceutical plant using multiple parallel production lines in campaign mode, and producing products with multiple intermediates.

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 optimal supply amounts of various AIs (new and old) to maximize the overall gross profit for the plant, while considering in detail the sequencing and timing of campaigns and material inventories. To model the sequencing and timing of campaigns, we use variable length slots that are synchronized on all the production lines at different times in horizon. We present a few examples to illustrate the effects of new product introductions on plant production plans. We attempt to answer questions such as

how much new/old products to produce, what-if some existing flagship products are already in tight schedule and so on.

Keywords: pharmaceutical plants, new product introduction, planning
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