OPTIMAL LOT-SIZING AND SCHEDULING IN BEVERAGE PRODUCTION PLANTS

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ABSTRACT

In the dynamic landscape of today's industrial sector, the food and beverage industry contends with the ongoing need to adapt to consumer preferences, meet regulations and sustain profitability amid intense competition [1]. Production processes in this sector are characterized by multiple intricate stages and shared resources, demanding careful monitoring [2]. Currently, production engineers rely on heuristic decision-making based on experience, resulting in suboptimal schedules that often fail to timely meet production needs and underutilize resources [3]. Recognizing the limitations of this approach and in order to achieve cost and time efficiency, strategic lot-sizing and scheduling decisions are necessary [4]. This study focuses on the lot-sizing and production scheduling of a real-life beverage industry. The proposed solution framework is a multi-bucket immediate precedence Mixed-Integer Linear Programming (MILP) model, tailored to the industry's unique features, aiming to minimize the plant's weekly operating time. The production process is modelled as a two-stage make and pack process and detailed timing decisions are made for each stage. Attributes such as short-term storage of intermediate products and overtime production are taken into account in the developed formulation. Furthermore, the introduction of intermediate storage vessels is considered and a comparative analysis of the two production layouts is conducted, revealing significant productivity improvements. Practical insights are gained for enhancing efficiency and cost-effectiveness through optimal lot-sizing and scheduling in production facilities of this kind.

KEYWORDS: Optimal production scheduling, Multi-bucket time representation, MILP, Short-term storage, Beverage industry

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