Contribution ID: **16** Type: **Talk**

Julia for simulation using a production planning model for helping SMEs in Decision Making

Wednesday, October 30, 2024 10:30 AM (30 minutes)

Decision-makers in Small and Medium Enterprises (SMEs) rely on available data and their environment knowledge to plan activities. In doing so, they may have contradictory criteria or insights according to different decision-makers. While Group Decision Support Systems exist in literature and industrial practice as well, their use can be complex and time-consuming for decision-makers.
In order to support decision makers, a framework is proposed through a Multi-Period Mixed Integer Linear Programming (MILP) production planning model that simulates the behaviour of a real company. Based on a real industrial problem, this model combines dynamic parameters (production capacity, forecasted demand, etc.) with static parameters (Bills of Materials (BOMs), deliveries, supplier capacity, etc.).
The model is implemented in Julia, using JuMP and the Cbc solver. First, decision-makers fill in the relevant data and parameters, which are then processed for being used by the solver. Decision variables such as production, deliveries, purchases, inventory, and back-orders are defined to simulate the company's behaviour at different levels. Inventory equilibrium and Bills of Materials (BOMs) are incorporated into the constraints in order to generate the production and supply plans over different time periods. These variables and constraints affect the company's expected benefit, which is incorporated into the model objective function.
The model serves as a simulation tool that generates production data, which can be used to complete Key Performance Indicators (KPIs) for each decision-maker. Both data and KPIs provides the necessary data for efficient group decision-making. The proposed simulation tool also enables decision-makers to test different scenarios, allowing them to better align outcomes with their risk tolerance and behavior.

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