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LEAD TIMES AND LAYOUT IMPROVEMENT AT HEAD COUNTRY BBQ

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ABSTRACT

Our case study involves using hybrid Simulation to analyze the performance of Head Country, BBQ sauce producer. Using the simulation model we evaluated the impact of suppliers' lead-time and facility layout re-design on the on-time delivery of the products . We performed scenario analysis on the model by changing supplier lead-time on two critical raw ingredients by observing the amount of backlogged customer demand as the suppliers' lead-time and replenishment quantities change. Based on the results, we re-designed the layout of Head Country's production and warehouse areas by evaluating the number of pallets of both raw materials and finished goods in the system and the travel time as well as distance traveled by forklifts. This study provides an implementation of lean manufacturing concept despite the challenges faced through supplier contract setups.

1 INTRODUCTION

The scope of this case study started as a warehouse expansion to accommodate for stocking raw materials. Our modeling process started with reviewing supplier purchasing contracts and demand forecast along with the dimensional aspects of the entire facility. One of the issues faced by the organization is the supplier contracts for two key ingredients that created an opportunity for inconsistent ordering and scheduling delivery of the ingredients. This contributed to production waiting for raw materials or overstocking of inventory. The overstocking of the inventory led the organization to believe that additional warehouse space would solve the issues.

2 MODELING CHALLENGES

Head Country's model is the hybrid model, which requires modeling of both discrete events and continuous flow of products. The discrete events in this model are, for example, the arrival of customer demand, raw material replenishment, etc. The continuous flow of the products is primarily in a production process, starting with metering of raw ingredients as they are transferred from their container, i.e. super-sack, into a scale, onto a cooking process, and a filling machine as a finished product to finish the flow.

Apart from the model is being complex as a hybrid system, the complexity increases with the requirement on the recipe. The recipe calls for a need to accurately measure the volume of raw ingredients in a cooking process to maintain a consistent flavor. To accomplish this, a monitor is required to properly measure the flow volume into a cooker, and to stop sending the ingredient that is already met volume requirement, and later to switch the flow of the ingredient to the next available cooker. So, the monitors have to work seamlessly and synchronously with all involved flow regulators in the cooking process.

3 KEY PERFORMANCE METRICS

With the model scheduled to run their annual forecast with demand fluctuation demonstrating the peak demand period during the summer and off-peak demand periods during the non-summer, the key output performance metrics looked at are:

1. An average number of available pallets of both raw and finished products.
2. Backlog percentage (% of time when a product is needed, but is not available) of both raw and finished products.
3. An average time spent on filling up a truck of customer demand.

4 SCENARIO SETUP

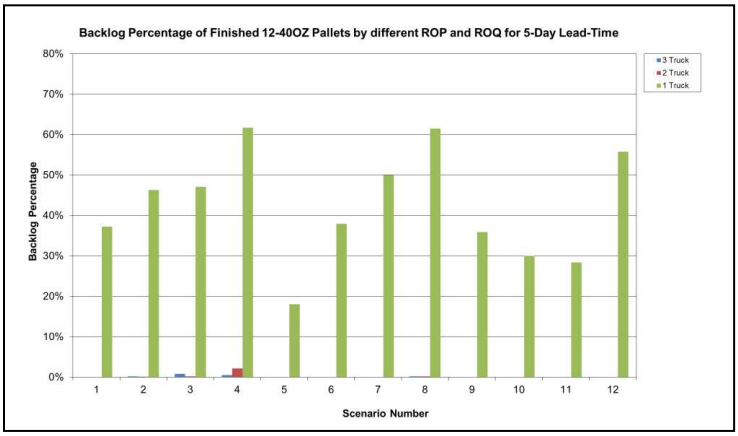
The objective of running scenarios is to determine the number of trucks assuming Full TL order quantity for two of their critical ingredients, i.e. ketchup and sugar, which Head Country would require to lower their backlog especially during the peak demand periods. We tested the following scenarios to evaluate (1) the impact of number of trucks and lead-time on ketchup's and sugar's backlog percentage, (2) the impact of number of trucks and lead-time on finished products' backlog percentage, and (3) the impact of number of trucks and lead-time on time to fulfill demand trucks. For each of the three lead-time scenarios (3, 4, and 5), we tested twelve scenarios, a combination of the reorder point (10, 20, and 30) and reorder quantity (10, 20, 30, and 40) of the finished products.

5 FACILITY LAYOUT

The entire production and warehouse areas need a new layout to minimize the space consumption of both finished and raw products and to allow a better flow of products as well as minimize travel time and distance of workers and forklifts. The output performance of the new layout should not be significantly influenced by the difference of supply contracts because the travel time of a forklift on duty compared to replenishment lead-time specified by a contract is relatively small. For the layout, we also numerically performed twelve scenarios by varying the reorder point (10, 20, and 30) and reorder quantity (10, 20, 30, and 40) of the finished products.

6 RESULTS

As shown in the plot, when the firm keeps the two major ingredients three truck loads in the warehouse, the backlog percentage for every finished product is significantly low, independent of re-order point and re-order quantity of finished products and suppliers' replenishment lead-times. As a result, the company decided to keep three truck loads and renegotiate a contract with five-day lead-time with the suppliers of the two ingredients.



After implementing such supplier-related decisions, the facility warehouse was re-designed. The new layout allows the system to work more effectively by specifying the storage area to each raw ingredient or material. By that, the firm can lower the annual total distance traveled by forklifts by approximately 4.2%. Also, the new layout would accommodate the re-design of the production area to expand production capacity as outlined in the next development phase. The initial plan by the company before the simulation was to overstock raw materials and build additional warehouse space to solve their inventory (out-of-stock) problem. Based on the implementation of five day lead-time, plans for new building expansion was shelved resulting in an overall savings in 22% warehouse space.