Simio Design Competition Executive Summary

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Purpose

Team Simi∞s was tasked with creating and optimizing a real world situation based off of Simio Shelving Shop's need to optimize the current low order fill rates (stockouts). The company is concerned about affecting the shop's bottom line. An external consultant recommended a new dynamic buffering and inventory paradigm known as Demand Driven Materiales Requirement Planning (DDMRP) to mitigate the current problem. Team Simi∞s set up dynamic DDMRP buffers in ther factory, levaeraging from pre-existing data proportionated by Simio, presenting a complete solution for this problem including a model, simulating several days of work for collecting data before trying it in real life. After that a full analysis and solution is presentend by Team Simi∞s.

Methodology

Before trying to solve the problem it is necessary to section it, divide and conquer. For this matter there were 3 phases defined:

Previous Data Analysis

Simio provived several data files with different valuable information about the current state of the Simio Shelving Shop, the first step was to run it by an ETL Process using Simio, an ETL is a process that extracts the data form a source and transforms (like applying calculations, concatenantions, etc.) it for a posterior usage, in this case the first step was to clean the incomplete, therefore useless data from the data files. The next step, was to order this data and group some of it for posterior analysis. Finally, the clean data was analyzed using R, for extracting statistical conclusion about the data provided and using it in the next phase. Each of the steps was done in an individual Simio model for order, and the last one was done using a scrip in R.

Data Modeling

With the final results of the data analysis and some other information provided by Simio it was possible to build a model simulating the current work of the Simio Shelving Shop, the first step was to locate the different workstations and inventory keys in the facility layout. Next we stablished the general routing logic of the 7 different type of materials across the 7 different tasks for delivering a final product, the data for the materials and tasks was provided by the problem and the analysis of the first phase. Then,the logic of the workers and the work schedule was added to the model, simulating the factory shifts and the employees in it. The last functional step was to simulate product demand which varies for each type of product, and the report that it generates at the end of every work day. For maximum approach to the real problem Simio provides a 3D Modeling function that was implemented paying special attention to details in the factory and adding representative 3D Models for each object present in the model.

Analysis and Problem Deliverables

The main objective is to maximize facility's order fill rate and minimize its inventory cost by changing the policy to the new dynamic buffering model. Order fill rate is defined as the number of units shipped on time divided by the total's day demand, and its inventory cost as the cost of all inventory in stock. For rating success the management defined the following metrics:

- Throughput
- Average unit time in system
- Workstation utilization
- Average inventory cost for each buffer
- Number of stockouts
- Unmet demand by day

With the results of the simulation of 1 week of work provided by the tool Simio and the equations provided in the problem statement this KPIs can be measured. The tool used for this posterior analysis was Microsoft Excel but Simio provides very detailed information that is useful also for measuring the metrics set by the management.

Conclusions and Recommendations

Using DDMRP to evaluate each buffer we can find an optimal point where we can have the minimum amount of material in inventory, while mantaining high availability of the necessary materials, which reduces the management of emergency orders.

Across workstations, workers and inventory keys utilization is very variable but something that can be improved is the unbalanced distribution of workload. Analyzing the results from the simulation we can find that some days inventories of shelves and shelf parts are not reaching the demand of the clients, and we also finish most of the days with low stocks, so next day, we have more work to reach the inventory goals.

The team recommends the DDMRP paradigm to approach the current Simio Shelving Shop problem about stock and low order fill rates, statistical data and a very detailed analysis supports this idea and is supported by the appendices of the results using Simio and Excel.