Simul8 in supply chain

PLYMOUTH BUSINESS SCHOOL COURSEWORK COVERSHEET GROUP WORK NAMES

By submitting this piece of assessment the group confirms that all the work is thoroughly and adequately acknowledge and referenced, and has been completed in accordance with the University and Programme Regulations.

Introduction

Simulation is one of the three quantitative analysis solutions and it is essential in logistics decision making. The simulation model can answer what-if questions in the existing system as for this case, the business needs to know and evaluate performance if two warehouses and four drivers can be pooled to compare the results and the influence of the supply chain performance, in order to give an optimal supply-production-distribution system decision. The researchers used the SIMUL8 program to run the simulations and draw the predictable models needed.

Current Simulation Model

Clock Options The business is working daily from Monday till Friday by which the shifts are starting from 9: 00 till 17: 00 (8 hours/day), and the time is set up in hours to monitor the start time and the length of each day. The warm-up period is crucial when building up a simulation for manufacturing models because there is no work-in-progress in such industries at the beginning of the process. Robinson (2007) stated that there are various methods to determine the warm-up period in the simulation model such as the model of run-in for a warm-up period until it reaches a steady-state and then the data are deleted and the model of a realistic initial condition at the start of the run. The first model was taking into consideration when determining the

warm-up period and has shown that the warm-up period is 280 hours. It is worth adding 20% to the normal warm-up period as a safety margin (SIMUL8, 2013).

Figure (1): Warm-up period. Results collection period. The result collection period is usually chosen to reflect an appropriate operating period. In this model, the period set to 1600 hours = 40 weeks. The researchers decided to choose 40 weeks as statistically n 30, it is important to use a large sample size to be more accurate and it is necessary to produce results among variables that are totally different. The number of trials used. After running the simulation model, it was important to generate the results required to help the company analyze the output data accurately. The more trials used, the more accurate the results will be. Approximately 3000 trials for both initial and pooling models are conducted to give sufficiently accurate results needed for the company.

Results analysis

Illustrates the results conducted after running the simulation of the model. The average time in the system is 110 hours due to many reasons in the supply chain which affects production plans that leads to poor delivery performance. Although the main objective of any manufacturer is to decrease lead-time in order to satisfy customers and achieve better delivery performance. Driver’s performances are 91% and they are considered as an important resource to deliver finished goods to end customers at the right time. The waiting percentage of the available vehicles is set to be 2% which cannot be considered as a factor that hinders the efficiency of customer

delivery. However, the working percentage of vehicles can be an enormous factor that affects customer delivery.

As shown in the appendix (2), vehicles are only operating at 79% of its total working ability. Since the warehouses hold finished goods and are considered to be an inventory, therefore it is crucial to minimize the capacity of the warehouses to achieve greater financial success. Appendix (2) shows that the average queue size of both warehouses is nearly 16 units whereas the maximum capacity of the warehouses is 50 units, thus the capacity of the warehouses is efficiently used. The average queue time of the available warehouses is another factor that must be taken in the prior considerations. An average of 34 hours is spent to deliver orders from warehouses to customers and this can be nearly 30% of the whole time spent in the system. The rule of thumb declares that once the goods are manufactured, it must be delivered as quickly as possible to reduce storage costs and to satisfy customers.

Pooling Resources

The impact of pooling resources is a possible method to improve service performance without adding any other resources. Pooling help to reduce the variability of data collection, however, pooling of customers adds variability to the system and no efficiency will be gained. Furthermore, it helps to reduce the average queue time in the system for the products; it is optimal to schedule the shortest job first and to give priority to short jobs (Downey, n. d.). Thus, it can reduce inventory holding period and costs. This method used in the model is called FIFO (first-in-first-out). Comparison between the initial model and pooled model 1- There are dramatic changes after pooling

warehouses, the queuing time dropped from 34 hours to 15 hours while queue size decreased from16 units to 15 units. As a result, the average time in the system declined from 110 hours to 88 hours, thus it can lead to better customer service, saving storage costs, and save time as well. 2- After pooling the drivers, it has influenced the waiting times of the vehicles to increase slightly from 2% to 2. 4%. While driver's utilization has improved significantly to rise from 91% to 93%, therefore drivers after pooling can respond quickly and flexibly to customers. The usefulness of the Simulation Model in the Business Context

Simulation and decision making

The simulation model can help real-world companies to provide efficient production and distribution systems as stated by Tunali et al. (2011). SIMUL8 has become the preferred tool as it brings solutions for production planning and scheduling to thousands of engineers that have complex supply chains and distribution systems such as Chrysler, GM, Ford, etc. SIMUL8 is easy to use and supports numerous critical decisions making every year because it enables us to create accurate and flexible output more rapidly. Moreover, it helps to bridge the ERP gap by creating new and feasible production plans. Analysis and assessment of business processes; development of what-if scenarios and export to implementation platforms, such as workflow management and ERP systems are the key advantages of simulation modeling because it enables the integration of these functions easily and more accurately (Verma et al. , n. d.). As a result, decision making can be easily overtaken and this is the reason why thousands of companies use

simulation modeling to optimize their supply-production-distribution systems.

Chrysler saved $5 Million by using Simul8 software which helped them to identify the best performance and bottleneck lines, thus it assisted them to slow it down. Simul8 also reduced the manpower on these assembly lines which have saved $ 600, 000 per year as labor costs. On the other hand, the researchers could not identify the best performance and bottleneck lines because it needs Simul8 professional software which is used in real-world companies and the need for historical data is crucial to be more realistic when identifying the bottlenecks in the supply-production-distribution systems. The researchers used Simul8educationsoftware in this case and they found out after pooling warehouses and drivers, significant results are achieved such as reducing inventory (from 16. 7 units to 15. 5 units) and the time of finished goods spent in the warehouse was also decreased significantly (34. 5 hours to 15. 9 hours). As a result, the lead-time dropped from 110 hours to 88 hours. Furthermore, the driver’s utilization increased from 91. 1% to 93. 6% after pooling the resources (drivers). Thus, the business could react more responsively to customers and achieve enormous financial success because of their drivers’ flexibility. According to McLean and Leong, simulation models can help manufacturing and operational departments to determine which new technologies need to be used, organize labor shifts and materials management required for each production stage, and modeling of supplier relationships.

Support the operation of the supply chain through " what-if". A trial of approximately 3, 000 runs was conducted to compare the available

manufacturing model results. Perform capacity planning analysis. Available capacities for warehouses in the initial model were set to 50 each, but it was planned to pool both warehouses together to have a capacity of 100 which delivers enormous results. Maximum batches for trucks and availability% of drivers were set which helped for planning the distribution process of the model. Establish the required resources for production and material. Determine and manage the required raw materials needed for assembling the product handling. (How many raw materials needed from each supplier) it can also be set on which statistical distribution used to supply these values materials as the simulation runs. Ability to evaluate overall firm performance. Every stage of the production and distribution process are evaluated such as working%, waiting for %, utilization of drivers, queue sizes, queue times, etc. As a result, this can help evaluate the performance of the company and assist the top management in taking the right decisions.

Researcher Recommendation

By using SIMUL8, the researcher suggested adding value to the company even after pooling their resources which affected insignificant results. The researches created a new model and recommended adding one more vehicle with the same amount of resources that are available (drivers, warehouses) to compare with the previous results. The following table shows even more effective results as customers received their orders in less than the time spent by using only 2 vehicles. It has also shown that the driver’s utilization increased significantly from 93. 2% to 97. 9% and this is due to a huge reduction in waiting times of drivers. Finally, warehouses queue size and queuing time have decreased to meet nearly the maximum efficiency by

which a slight amount of inventory holding and a very tiny amount of time is spent inside the warehouse where most of the finished goods are ready for delivery to customers once arrived.

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