

Optimization of the lead time to customer at Trelleborg Industri AB

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This article is based on a master thesis conducted at Trelleborg Industri AB in Trelleborg during autumn 2010. The aim of the study was to examine whether the order planning could be improved and what the consequences would be. The article will address the problem that the company is experiencing and the purpose of the thesis. Furthermore, the findings will be presented and the article will conclude by discussing the conclusions.

Introduction

Trelleborg AB is a global industrial group that is a world leader in manufacturing of rubber products for demanding industrial environments. Trelleborg is active in the segments of passenger cars (automotive), transportation, agriculture, infrastructure, aviation and offshore (oil and gas).

The site in Trelleborg produces products such as rubber sheets, rubber compounds, industrial hoses and laminate materials. The company has a high expertise in their area and the production is becoming more high tech in order to be able to meet customers increasing demands for products that must withstand heavy use and harsh environments.

As the competition in the industrial rubber market increases it becomes more and more important to produce products as cheap as possible as well as delivering the products on time and with the right quality. A significant part of a company's competitiveness is its ability to deliver on time. Short lead times lead to increased competitiveness and it also makes it possible to charge a higher price. Price competition can thus be avoided and a better profit margin can be ensured. [1]

Trelleborg as well as some of its competitors focuses on delivering products with a high

quality. Long lead times can thus result in customers choosing a competitor instead, especially if they can get the product faster and for the same price. A long lead time also increases the tied up capital as well as decreases the delivery accuracy.

Problem discussion and purpose

For a long period of time, Trelleborg Engineered Fabrics (EF) in Trelleborg has experienced problems with long lead times and low delivery accuracy to its customers. EF believes that an underlying cause to this problem has to do with how they plan orders in the machines. Long lead times and low delivery accuracy can make existing customers choose a competitor instead, particularly if they can deliver the product faster and to the same price. The problem formulation that the thesis tried to answer was whether the order planning could be improved and what the consequences would be. The purpose of the study was to come up with improvement proposals to shorten EF's lead time by half and increase the delivery accuracy to its customers.

Methodology

The thesis was based on a system theoretical approach because it was mainly based on a

simulation, where the interaction between the production and the planning methods were studied. A positivistic approach was also used since the authors have had an objective approach to the studied subject.

An abductive research approach was used because the authors had to acquire knowledge and theories about different planning methods since neither one possessed any knowledge about this earlier. The ambition of the thesis was predictive since the aim was to come up with improvement proposals on how EF could shorten their lead time by half and increase their delivery accuracy to its customers.

Both qualitative and quantitative methods were used to collect data for the empirics. Qualitative secondary data was gathered through a literature review and qualitative primary data was collected through interviews and observations. Through EF's business system, Movex, quantitative secondary data was collected. To achieve a high credibility in the thesis standardized methods was used. When the literature review was conducted and when uncertainties appeared several sources were used to increase the credibility additional.

Findings

Order planning

The largest customer has a high frequency of customer orders. Currently the orders are being placed via email to customer service which registers them in Movex before the orders reaches the production planner. Since the largest customer also uses Movex the lead time could be reduced if they would place their orders in Movex instead of placing their orders through customer service as they do now.

Production planning

A problem that has been identified that is contributing to production disruptions is that orders are being released into production without ensuring the availability of materials. The problem could be solved by introducing two

lists. An active list that will contain all orders that can be produced when material is available. A passive list that will contain all orders that cannot be produced since material is missing. As soon as a passive order has material it should be moved to the active list.

To prevent the machines, K24 and K42, from not being used because material is missing, are to use the possibility to coordinate these two. It would mean that it would not matter which one of the machines that had material, because the one with available capacity could produce the order. The flexibility that exists between K24 and K42 is not fully used currently, which affects productivity and machine utilization. K55 flexibility is restricted in the sense that it runs thicker types of rubber, which means that the orders cannot be rescheduled on another calendar machine.

EF is trying to apply the Just In Time (JIT) principle but for JIT to work, a flow free from disruptions is needed. The authors do not consider currently that a transition from a pull-system to a push-system is possible. This is partly based on Material and Mixings (M&M) low delivery accuracy to EF, but also because rubber related causes stands for half of the total amount of delays within EF. This means that EF stands for the second half of the delays which must be addressed before a transition can take place.

Production monitoring

Currently there is no connection between the materials that are being ordered and the manufacturing orders in the machines. This means that it is difficult to know which material belongs to which manufacturing order. Furthermore, this means that a material that was meant for a particular order could be used by another order further up in the machine list.

Currently the production planner can see in Movex where the material is in M&M's supply chain, but to do so a quite number of steps are required in Movex to obtain this information

for each order. If it would be possible to automatically see when a material would be available, this would facilitate the production planning.

Tied up capital

According to calculations the average delay from M&M to EF is 4.1 days. Through the simulation model an average cost was calculated to keep a buffer stock for four days and it was around 950 000 Swedish crowns. A buffer stock of this size would theoretically increase M&M's delivery accuracy from $x\%$ to 90% but it would also extend the lead time with four days. A buffer stock would increase the likelihood that the material would be available at the first time of planning an order with 26% . It would also give the production planner a bigger opportunity to give the customers an accurate delivery date, which in turn had increased the delivery accuracy. A buffer stock would also reduce the disruptions in production.

Simulation results

A simulation model was created to simulate production. Three different planning methods were simulated, FIFO (First In First Out), SPT (Shortest Processing Time) and EDD (Earliest Delivery Day) for each scenario that was simulated.

The first scenario, zero-days lead time from M&M and with 100% delivery accuracy, shows that EDD gives the highest delivery accuracy, followed by SPT. FIFO gives the lowest delivery accuracy. Regarding the lead time, SPT has the lowest lead time which has to do with orders with long processing time. After the simulation they remain in the backlog as long orders end up further back in the backlog.

In the second scenario with 23 days lead time from M&M and with $x\%$ delivery accuracy, the remaining $x\%$ was given a random delay that corresponded to a calculated distribution. This to mimic reality as much as possible since it is not possible to know which materials will

be delayed. Scenario two is the scenario that the model was validated against. When FIFO, which is the current planning method was compared between the model's output and the output from the calendar department the outputs corresponded well. Scenario two shows that FIFO gives the lowest delivery accuracy and the longest lead time. EDD gives the second lowest values and SPT gives the best values.

The third scenario, 23 days lead time from M&M and with 100% delivery accuracy shows that the values are similar to those in scenario two. The reason for this is that when the lead time is so long from M&M the delay does not affect enough for it to be visible over a long period of time. Since a backlog is built up in both scenarios there are always other orders that the model can run. Another reason why the delivery accuracy is similar in both scenarios is that although materials is delayed for an order, it will appear as it is on time in the model as long as the order does not have a desired delivery date.

Scenario four and five was simulated in the same way as scenario two and three. The only difference was that M&M's lead time was set to ten days. The results show that if it is possible to obtain material earlier from M&M this would result in higher delivery accuracy for EF. As in previous scenarios, the lead time for SPT was shorter than for the others. The reason for this has already been explained. It is possible to conclude that if M&M's lead time was x days shorter then EF's lead time would be x days shorter.

The values from scenario five are similar to those in scenario four which shows that it is more important for M&M to reduce their lead times than increasing its delivery accuracy. It should be added that the average delay must not increase, as it will affect the delivery accuracy to a greater extent.

Conclusions

There are a number of improvement opportunities regarding EF's logistics. During the project it became apparent that the planning process is based on old principles. The planning method that always has been used is FIFO. The results of the simulation model shows that FIFO is the worst planning method, in every aspect, in comparison with SPT and EDD. An amendment to the planning method is therefore recommended.

The planning method which gives the best results is SPT, but it is also the most difficult planning method since the production planner has to plan the orders according to the shortest operation time, resulting in long orders to end up far back in the backlog. For these orders to be delivered on time the production planner has to prioritize these orders after a certain waiting time to prevent them from not being delivered on time. Furthermore, it is required that the customers are willing to receive their product sooner if it is a short order. SPT is probably the best option from a longer perspective, but it will require a full understanding of the planning method.

A first simpler step to increase the delivery accuracy and to reduce the lead time is to plan according to EDD. By planning according to EDD the lead time will decrease with x days and the delivery accuracy will increase with about x %. This will not involve any investments, but merely an another way of planning orders.

By comparison of current lead times from M&M (x days) and lead times from the Calendar department (x days) the difference is x days. In other words, EF's own lead time from the Calendar department is x days on an average. By planning according to EDD the lead time for the Calendar department would decrease with x %.

To increase the delivery accuracy furthermore, it is recommended to introduce a buffer stock

which will include four days of production. The buffer stock will cover up to x % of all cases for the lack of delivery accuracy from M&M but also ensure constant production. The downside of the buffer store is that the lead time will be extended by four days, but in contrast to the ability to have a delivery accuracy rate of over x %, the authors consider this to be an appropriate step to take. The buffer store will if introduced tie up approximately one million Swedish crowns in capital.

Furthermore, it has become apparent that it is M&M's lead times and not their delivery accuracy that has the biggest effect on EF's lead times and delivery accuracy. If M&M can reduce their lead times then EF's lead times could also be reduced.

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References

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