

## MASTER

### The remanufacturing of endmills : a logistics structure to determine and realise reliable delivery times

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## The remanufacturing of endmills

A logistics structure to determine and realise  
reliable delivery times

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UITLEENBAAR**



TBM

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Driving the future... together

**NIET  
UITLEENBAAR**

To: Rob and Federico



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Linda Rutten

## **Abstract**

Mitsubishi Carbide wants to launch a new service: the remanufacturing of used endmills. Grinding is done in England, coating in Spain; the customers are distributed over Europe. This report gives a model for this new flow through Europe, which realises that the accepted tools will be delivered back to the customer in 15 working days with 100 % reliability.

## Management summary

### The company

This graduate project was executed for Mitsubishi Carbide Europe. The company has offices over the whole of Europe. These offices work independently and are responsible for their own profit and loss. This project is executed for the new English grinding company (MEE), the new coating company in Spain (MCE), and the European headquarter and German sales offices (MHG). MEE and MCE were attracted / opened for the new remanufacture service. In this new service the companies have to work closely together and the goods flow through a new chain of European companies.

### The project

This project is concerned with the logistics of the new remanufacturing service of endmills. This is a new service in which MEE, MCE and the sales offices co-operate. In the remanufacture service the customers can send the used tools back. The customer receives his own tools back with a new grinding and coating, which gives the tools the same quality as new ones. The price is 60 % lower than the price of a new tool.

Because of this new co-operation and the new goods-flow through Europe, the best logistics design of the endmills over Europe needed to be developed. To simplify the design this project concentrates on the German sales office (MHG) instead of all the sales offices, but any sales office can use the final model. The orders have to flow through the chain MHG - MEE - MCE - MHG.

The project focuses on delivery time, because this is a core issue for the customer.

### The service

The delivery time is 15 working days from order receive in MHG until the customer receives the tools back. All the orders get the same delivery time.

The customers can send the orders in on any day. The order composition can vary strongly. There must be at least 10 tools in an order, the quantity doesn't influence the delivery time. Neither does the composition of the orders, the number of different tools in an order can vary strongly.

Orders must be delivered back to the customer as complete orders and they can't be split.

### Analyses

At first the technical possibilities of endmills, the remanufacturing restrictions and the history of and relation between the companies playing a role in the service were studied.

After that an analysis was done, which distinguished for external and internal factors.

Externally was investigated:

- The delivery time the customers require
- The number of tools going to flow

Internally was concentrated on:

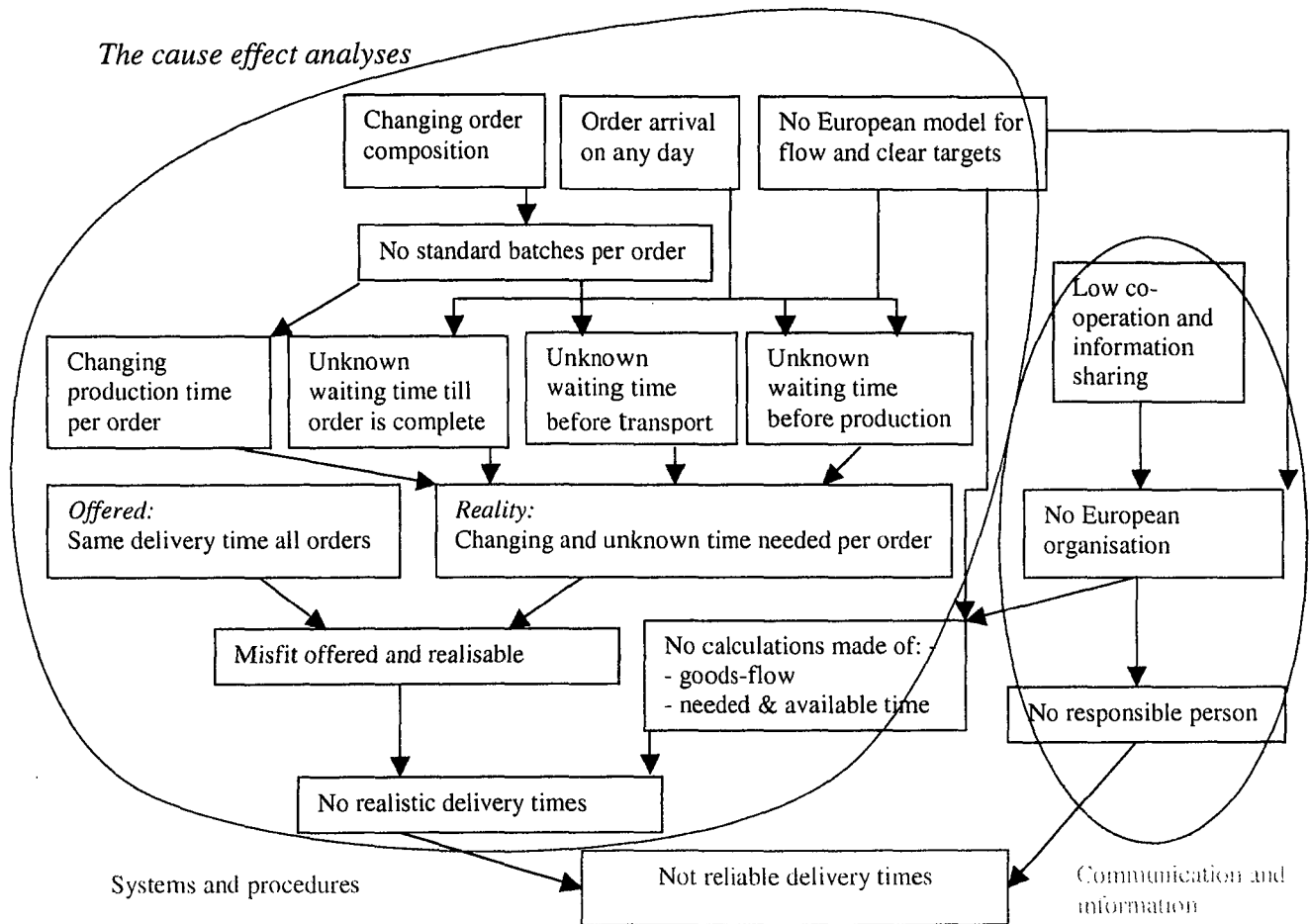
- The goods-flow in every link of the chain
- The throughput times needed in each link
- The information system



### Result of the analyses

The results of this analysis were studied and structured into a cause-effect analysis. The core issue is not reliable delivery times. The customers complain about the reliability of the other products sold by Mitsubishi Carbide. Analysing the new service, the experts stressed the reliability will also be crucial for this service. Considering the processes in the chain showed the delivery times vary strongly.

### The cause effect analyses



The major issue is the lacking of an European model, the changing order composition and order arrival on any day. Someone else works on the communication issue.

### Final project definition

From the results of the analyses the goal of this project was defined as:

*"Designing a logistics structure for the remanufacture flow through MHG, MEE and MCE. The structure can determine and realise reliable delivery times"*

The performance requirements for the structure are:

- Maximum delivery time: 15 working days, form order arrive in MHG till customer
- The accepted tools are delivered on time with 100 % reliability
- Orders may contain any quantity of (different) tools

### **90 % Service**

The orders may contain any quantity of different tools and can arrive on any day. Especially MEE has many different batches through which the tools of an order might flow and capacity is restricted. The orders may not be delivered back to the customer into split suborders. The capacity reservation is based on 90 % tool acceptance. Depending on the quantity and composition of orders, the tools are accepted in such a way that the reserved capacity can produce the accepted tools with 100 % delivery reliability.

### **Modelling the quantity of goods going to flow**

At first the future goods-flow was modelled. Because this is a new service, no history data were available. Based on the collected data during the analyses, the goods-flow was modelled. A certain percentage of the sales of new tools will come back for remanufacturing. The future model states the tools come back after a certain time span. Another model was made to calculate the expected flow for next year, when the remanufacture service starts. Based on this model the quantities going to flow for the different batches in MEE and MCE were calculated.

In both of these models the 90 % tool acceptance are taken into consideration.

### **Modelling the European flow**

The orders have 15 working days to flow from MHG back to the customer. During the analyses the days needed for transport and the days in MHG were determined as fixed. MEE and MCE together can use 10 working days. The time they need strongly varies depending on the order composition.

The times MEE and MCE need were calculated. For this the time needed to produce the calculated quantity of tools flowing through the different batches was compared with the capacity available in MEE and MCE. The calculations show MEE and MCE both need at least 5 days to handle the orders: MEE and MCE get 5 days each. The information system doesn't allow for splitting the orders between the links in the chain. The tools flow as complete orders through the chain.

MEE needs to reserve 93 % of the capacity, MCE 62 %. Based on the real goods-flow and the reserved capacity, the tool acceptance is done. Only the quantity of tools, which can be finished on time with the available capacity, is accepted.

Considering the way the service is going to be offered, the production planning will be difficult, the capacity use not optimal, daily transports are needed, order acceptance will be hard and also the control is difficult.

### *Changing the service strategy*

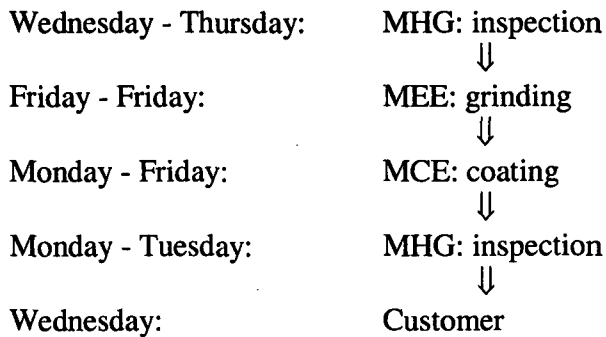
Because the service isn't launched yet it's possible to change the way the service is offered. This improves the mentioned factors.

The effects of the changes have been listed and discussed with the involved people. The service was adjusted into a situation where:

*The order has to be in MHG on a fixed day in the week. If orders arrive later, the delivery time increases. This increase is the difference between date of order arrival and next fixed day for order arrival.*

This change improves the order acceptance, the capacity use and production planning, the goods-flow control and it decreases the numbers of transports needed.

The model for the order flow will be as follows:



Between the links the transports take place. The total throughput time is 14 working days.

### **Evaluation**

The model structures the order flow. If MEE and MCE reserve the calculated capacity and if the tools are accepted based on this capacity, than all the tools are able to flow through MEE and MCE within the 10 working days. The maximum time in each link of the chain is known and if the companies realise these times, the delivery time of 15 working days is achievable.

### **Implementation**

The implementation will be in 5 stages:

1. Rounding off project
2. Preparation launch service
3. Launch service
4. Process control and analyses
5. Improve system

The stages consist of some steps with responsible persons and the deadline or frequency.

### **Recommendation**

Recommendations are made regarding the possibilities to expand the capacity and the adjustment or buying of supporting software. The order acceptance is highlighted and the improvement of the European level stressed. A remark is made to decrease the number of links in the total chain. Last but not least a recommendation is made to share the profit, since this is a low profit service, which absorbs a lot of capacity in MEE and MCE.