Effectiveness and elaboration spare-parts organization

When we discussed the spare-parts organizing system in the case-study, we had one central warehouse serving multiple local warehouses and each local warehouse serving multiple installed base locations. In this system, lateral transshipments between the local warehouses and repair options were not allowed. This can be seen in figure 1.

![Figure 1: The basis spare-parts organizing model. A central warehouse supplies multiple local warehouses. A local warehouse supplies multiple installed bases.](image)

A more effective but also more complicated model can be seen in figure 2. This model is more complicated in real life, however, in order to enhance the effectiveness of the organizing system, the benefits may be large. The options added are the lateral transshipments of spare-parts between the local warehouses and the installed bases of other serving locations.
In even more advanced systems, the local warehouses may even be divided into main local warehouses and regular local warehouses with transshipments. This organizing system will look like the same as the system in figure 2 with the local warehouses looking like figure 3.

**Application by ASML**

This last, more complicated organizing system, is called the multi-item, multi-location model with lateral transshipments between local warehouses. A company having experience with these two models is ASML. ASML is a Dutch company and currently the largest supplier in the world of photolithography systems for the semiconductor industry. Among their customers they deliver these machines to: Canon, Intel, Samsung, TSMC and many more large industries. ASML changed their organizing system to the organizing system with the lateral transshipments with the difference in local warehouses and the repair opportunities. This conversion in spare-parts organizing system
reduced the cost with 30% which results in millions of savings in the spare-parts organizing system and a higher service degree. This proves the effectiveness of applying an effective organizing system.

A simplified version of the old system from ASML can be seen in figure 4.

Figure 4: Old simplified situation with only one central warehouse serving seven local warehouses.
The newly adopted version of ASML’s spare-parts organizing system can be seen in figure 5 with two local warehouses changed to main local warehouse.

In the case of ASML, they have 19 local warehouses in the United States being responsible for 1451 resources. The prices of these resources vary from cheap too expensive with a difference of multiplying factor of $10^6$ between the cheapest and the most expensive one. An example would be, the cheapest resource would cost about $1$, and the most expensive would cost $1,000,000$. As general rule, the holding cost per year is around $0.25$ of the price of the spare-part in a local warehouse.

ASML has 27 groups of machines with the 19 local warehouses each serving one or two machine groups. The different groups being served by local warehouse contains different machine types but with they have some common spare-parts. The waiting time is around 0,15 days and the component with the highest demand is still very low with 39 units per year. Four local warehouses are converted to main local warehouses.

The largest difference between the new and old system is the base stock level. Almost all the base stock levels at the local warehouse are equal to 0 or 1. The spare-parts at the local warehouses had overlap which meant an inefficient. This new organizing system with the lateral transshipments between the locations make a more balanced system possible. Price demand ratios are applied in order to organize spare-parts at a warehouse. The lower the ratio the higher the number of warehouses where the spare-parts are placed in stock. In order to improve this the Greedy heuristic is applied for planning the spare-parts inventory in all the local warehouses. This change reduced both waiting times and costs considerably which lead to a new and more efficient spare-parts organizing system.
References