Network Optimization of Spare Parts Logistics Flows in a Global Scale

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Summary:
This study proposes a Supply Chain Network Design model for Spare Parts in the Personal Computer industry that goes beyond the company boundary to reach the supplier's network. The goal is to unfold hidden synergies that may lead to cost reduction opportunities by facing third party assets as a possible extension of a company distribution network.

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KEY INSIGHTS

1. In an effort to reduce costs, consumer goods companies outsourced operations to third parties usually located far from main markets.
2. The lanes and flows of 3PL's and Companies are optimized for their own operations.
3. An end-to-end approach targeted to optimize the whole supply chain proved to save €2.21 million per year (5.3% of the Baseline).

Introduction

The ever-increasing level of competition among companies in the consumer goods industry has forced players towards numerous cost reduction initiatives in order to sustain their value propositions.

In this sense, companies competing in the Personal Computer industry went into a process of outsourcing their production to China, setting up global HUBs to fulfill the demand in more developed countries. This phenomenon has led to lower total sourcing costs in exchange for increased need for coordination of international logistics to move products on a global scale.

During decades, the mechanics of the third parties' operations were ignored by the companies that contracted their services since much optimization was still possible within their own operations. The company behind this case study is no different. A series of footprint review initiatives were conducted generating great supply chain savings.

Now, with the EMEA (Europe, Middle East and Asia) Spare Parts network at a mature state, supplying more than 100 countries through 22 local hubs and one Distribution Center, the organization saw an opportunity to extend the scope of the supply chain beyond the company boundaries. The goal was to include the 3PL facilities in an end-to-end mathematical model to reveal new network optimization opportunities.

The model was created using the Supply Chain Guru software from Llamasoft, a tool designed to deal with complex projects at a global scale. Several possible combinations of flows were analyzed to get to an optimal scenario that represents savings of €2.21 million per year.

Setting up the scenarios

The studied supply chain operates in five layers or echelons. The two first layers are owned by the 3PL (one in China and one in the Czech Republic), while the next three are managed and operated by the company (the DC in Netherlands, Country Hubs and Clients Locations).

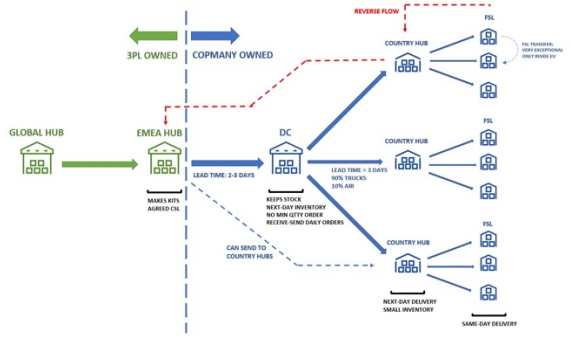

Figure 1: Representation of the multi-echelon network

This multi-echelon footprint is mostly linear, meaning that products flow from the supplier in China to a hub in the EMEA region to then reach the company DC that ships products to the Country Hubs and, finally, clients. Most orders go through all these 5 locations before being fulfilled (exceptions are urgent shipments and specific events or resale flows).

The scenarios to optimize the product flows tested how the 3PL network could be leveraged bypassing some of the current nodes that represent additional moves and consequently additional transportation, handling and inventory costs. These possible links were analyzed by first generating a Baseline that reflects the current operation showed in Figure 1 and then relaxing three specific flow constraints to identify the opportunities. The constraints relaxed are:

1) Ship to Country HUBs directly from China.
2) Ship to Country Hubs directly from Czech.
3) Ship to the DC directly from China.

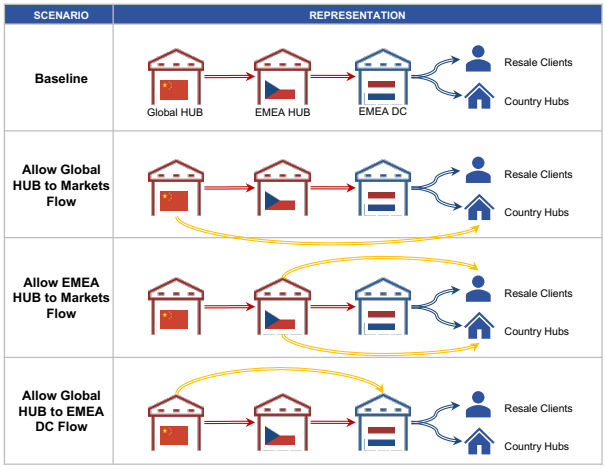

Figure 2: Scenarios tested on the model

Building the optimization model

Once the scenarios were structured, the most challenging part and the core of this study was building the optimization model. With workshops and deep dive sessions into planning, logistics and finance areas, 32 Key Design Decisions were made, data regarding Costs and Master Data was collected and cleaned to fill 14 tables in the system.

When dealing with a third party a lot of uncertainty is included. The lack of involvement and the confidentiality terms in the contracts with the 3PL make the input data less accurate increasing the need of extensive sensitivity analysis on the most uncertain assumptions.

After interactions and adjustments, the Baseline model had €42 million in annual costs with an adherence of 98% to the actual P&L, representing very well the operation. Still, costs for the new links had to be gathered, so a mix of rate cards from other business units and new assumptions were made.

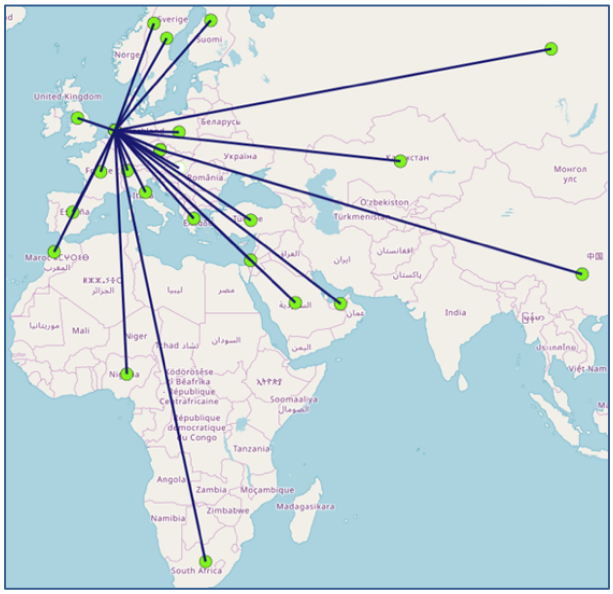

Figure 3: Baseline with linear model and €42 million in costs

Selecting the optimal model

By relaxing the Baseline constraints, new possibilities were analyzed. It turned out that all the changes resulted in savings being the flow from China to the DC in Netherlands the most relevant one.

The scenario selected represents the best alternative to supply each of the 22 Country Hubs. Four of them are supplied directly from the Chinese HUB, representing €0.69 million in annual savings. Three are supplied from the Czech Hub of the supplier representing €0.14 million in annual savings. This node also supplies 11 countries for direct client delivery of resale products and this change generates a cost reduction of €0.55 million per year. Finally, the remaining 15 Country Hubs maintain their supply in the Netherlands DC, which has the parts coming straight from China, and this new link represents €0.83 million in annual savings.

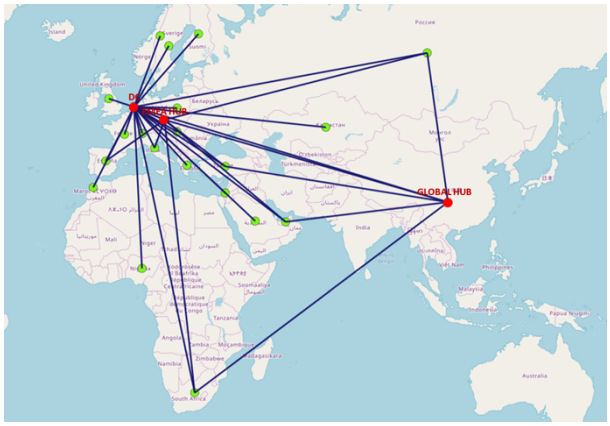

Figure 4: Selected scenario with non-linear flows

The majority of the savings come from inbound and outbound costs reduction. Transportation and taxes play a small role in the model and the same happens with inventory holding costs that go slightly up due to increased lead times on the new flows. The total reduction of €2.21 million per year represents 5.3% of the €42 million Baseline.

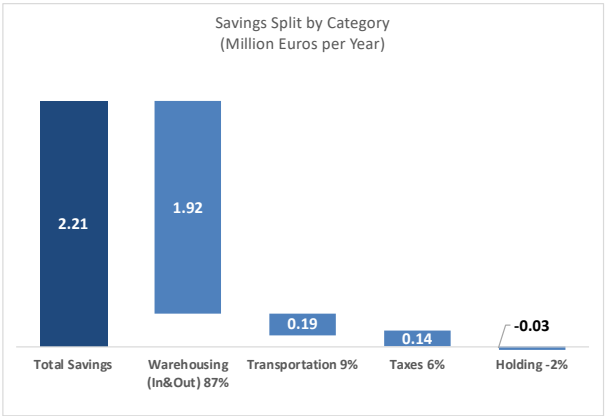

Figure 5: Savings split by category

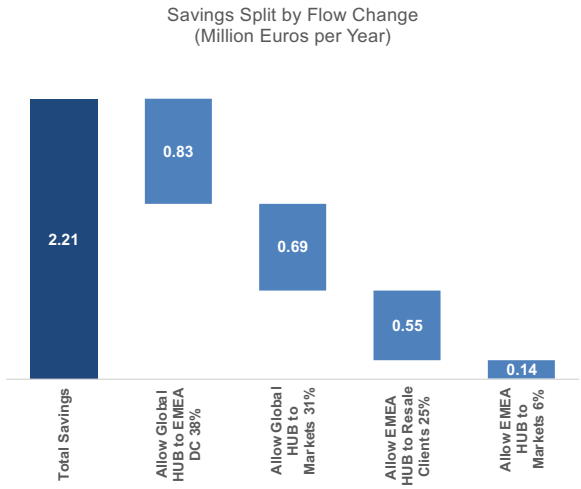

Figure 6: Savings split by constraint relaxation

Conclusions and Recommendations

In this work, we expand the classic approach of Network Optimization to include the supplier network on the end-to-end model. By doing so, we faced new challenges such as access to the supplier data and the need to stress assumptions.

The results must be faced as a first step towards a higher integration among the two networks. Going forward the company will have the challenge of implementing the changes by negotiating the savings split with the 3PL and ensuring the new rates. The ordering process will need to be adapted to the Country Hubs, and inventory policies will need to be adapted.

The use of a leading-edge tool was an accelerator and allowed the team to focus on the scenario analysis. Additionally, it equipped the company team with a powerful analytical model that represents the end-to-end Supply Chain operation of Spare-Parts in the EMEA region allowing further enhancements and projects. Among these future initiatives we suggest a prioritization of the joint inventory planning that is estimated to generate at least €3 million per year.

Cited Sources

Ellram, L.M. and Cooper, M.C. Supply Chain Management, Partnership, and the Shipper - Third Party Relationship, *The International Journal of Logistics Management 1*, no. 2 (July 1990): 1–10

Zacharia, Z.G., Sanders, N.R. and Nix, N.W. 2011. The Emerging Role of the Third-Party Logistics Provider (3PL) as an Orchestrator. *Journal of Business Logistics 32* (1): 40–54. https://doi.org/10.1111/j.2158-1592.2011.01004.x.

Diabat, A., Abdallah, T. and Henschel, A. A Closed-Loop Location-Inventory Problem with Spare Parts Consideration. *Computers & Operations Research 54* (febrero de 2015): 245-56. https://doi.org/10.1016/j.cor.2013.08.023.