Study of a supply-chain concept based on a multi-criteria analysis and a risk evaluation of different scenarios

Context
In regards to an upcoming major railway project, the Bombardier Transportation production site in Villerupt (CH) is confronted with a make-or-buy decision for its logistics strategy. A first estimation of the required storage space (based on benchmarking) forecasts a surface lack of several hundred square meters in the current central warehouse. Therefore, the management is considering externalization of warehousing, along with other logistics functions, in order to fulfill the surface deficit. Thus, two strategies are considered:

A: Internal warehousing and externalization of the overhead inventory
B: External warehousing and inventory for all materials

Goals
The project purposes are the following:
- Quantify more precisely the required storage space, by taking into account in a dynamical way both component needs and supply reliability.
- Perform an estimation of logistic costs for different supply scenarios and draw a comparison of both strategies A and B.
- Show the impact on storage space and costs in case of variations in the lot-sizing policy and the supply reliability.
- Provide a quantitative support in the decision-making process of the logistic concept elaboration.

Storage space requirement
The simulation runs have consisted in 19 scenarios, combining different lot-sizing policies (1, 2, 4 or 6 car equivalents) and delivery reliability levels (proportion of components with respectively A-, B- and C-level delivery). To each of the latter corresponds a given level of security stock, such that the production service level is maintained at 100%.

For each scenario, gross storage surface requirements have been determined (including circulation, handling and stacking), based on the 95% highest inventory level values. Results show that the company estimation is realistic when a majority of components are delivered in A-level (S1.1-S1.4), while it appears to be underestimated in case of lower supply reliability (S2.1-S3.4).

Logistic costs comparison
Based on the average surface during the simulation period, logistic costs (including storage, picking and JIT deliveries from 3PL) have been calculated. Results show that a storage space externalization is only necessary with the eight most pessimistic scenarios (in terms of delivery performance).

Conclusions
- The MRP-based simulation model has allowed measuring different KPI, among which the inventory levels throughout the whole project period (2013-2019).
- Depending on the component (generic or specific) and the supply performance, security stock levels have been determined so as to reach a 100% production service level.
- Results have pointed out that a critical issue for both storage space and costs is the supply reliability, requiring therefore an even closer monitoring.
- Threshold values defining profitability limits between both logistic strategies have been provided, so as to bring quantitative figures to negotiations with 3PL/4PL providers.

Acknowledgements
Stéphane FAKERY
Prof. Rémy GLARDON
Olivier GOBET