# Integrated Production and Outbound Distribution Planning in the Automotive Industry

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**Abstract**

Sustainable production and distribution become increasingly important for vehicle manufacturers. The distribution of finished vehicles provides many possibilities for rail transport to transshipment points, given the high transportation volume and the railroad access at both manufacturing plant and transshipment point. Yet, often trucks are used for shipping cars from the plant to the transshipment point. We propose an integrated planning of production and distribution on an aggregate level several weeks before production. It is compared to the currently applied two-step approach.
After a brief review of the state of the art in integrated production-distribution planning, general and industry-specific requirements are derived. A mathematical optimization model is subsequently created, combining a multi-resource general assignment problem (MRGAP) and a minimum cost network flow problem (MCNFP). The separately obtained solutions of MRGAP and MCNFP are provided as a starting point for a standard solver on desktop hardware to speed up the solution process. The model is applied to three different use cases with industry data from a German vehicle manufacturer. Solutions are evaluated with KPI considering cost, performance, environment, and computing time. The integrated model proves superior in all but the last category. On average, considered costs are reduced by 27%, rail transport is increased by 29%, waiting time for transport is reduced by 35%.
Finally, a corresponding business process for the application of the model is outlined, describing interfaces to other planning activities such as sequencing. The process can be used for implementing a decision support system.

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