

# ESCF OPERATIONS PRACTICES: INSIGHTS FROM SCIENCE



## Transportation Planning at Jan de Rijk Logistics



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European Supply  
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# Outsourcing of logistics at Jan de Rijk

## CONCISE SUMMARY OF THIS BEST PRACTICE

Nowadays, the outsourcing of logistics to service providers has become an integral part of the supply chain. Trucking companies are responsible for offering reliable, cost efficient, innovative and sustainable logistics. In order to provide excellent service to the customers and to control costs at the same time, logistic service providers need to organize the planning process of all freight requests efficiently. On daily operation, planners have to consider multiple parameters and variables of freight requests to design efficient transportation plans. This describes the need for a decision support algorithm as designed for Jan de Rijk Logistics. In collaboration with Eindhoven University of Technology (TU/e) two models were developed that provide fast and high-quality decision suggestions to the planners of the organization during the planning process. In addition, assets requested from third parties, called charters, are integrated by virtue of the charter selector. Using the decision support algorithms as implemented in the planning system, planners are able to compare and assess various scenarios and then plan the optimal combination of asset, driver and route. The decision support algorithms that were created take into account many aspects and are applicable to both full-truck load (FTL) and less-than truck load (LTL). As a consequence, reduction on planning time and decreasing emission levels are realized. Altogether, Jan de Rijk Logistics feels that their planning is more efficient in terms of cost, service level and in the end customer satisfaction thanks to the implemented decision support algorithms.

## KEY TERMS

Transport Planning, Transport Resource Allocation, Third Party Logistics

## RELEVANT FOR

Transportation Planners, Supply Chain Planners and Buyers

# Introduction

The supply chain is an essential part of organization's operations. The outsourcing of logistics to service providers has become an integral part of this supply chain. Trucking companies are challenged and with a lot of new opportunities. They are responsible for offering reliable, cost efficient, innovative and sustainable logistics solutions to their customers, regarding transportation and distribution. One of the leading logistics service providers in this market is Jan de Rijk Logistics, possessing 26 locations in 15 countries, 650 trucks, 1,000 trailers and providing daily intermodal transport. Jan de Rijk Logistics provides a variety of services including intermodal solutions, international transport, temperature-controlled transport, warehousing, Benelux and retail distribution, container transport, event logistics and forwarding (<https://www.janderijk.com/>).

In addition to all the distinct services, the logistics service providers industry consists of various sectors which have their own characteristics and requirements. Different sectors where Jan de Rijk Logistics operates are aerospace, automotive, healthcare, high-tech (and electronics), perishables, retail, non-food retail, tobacco and air cargo. One could imagine that acquisition of the right type of assets consisting of a truck (pulling unit) and a trailer (pulled unit) is essential to keep individual customers from all sectors satisfied.

Due to the fact that the assets of Jan de Rijk Logistics are limited, it is possible to make use of external trucks and trailers. Also, in many cases and for various reasons Jan de Rijk's own assets cannot be used. In both cases, assets are requested from other third parties, called charters. Logically, this makes the acquisition of the right type of asset even more complex. However, routing all transportation requests as optimal as possible will lead to the best service level for Jan de Rijk Logistics' customers.

In order to provide excellent service to their customers and to control costs at the same time, Jan de Rijk Logistics needs to organize the planning process of freight requests efficiently. Several projects to realize and thus optimize this process were executed in collaboration with Eindhoven University of Technology (TU/e). In the remainder of this report, the results of these projects are elaborated, starting with a better understanding of the planning process within Jan de Rijk Logistics. Subsequently, the savings generated through the researches are described. The report will be concluded with the impact of the results for Jan de Rijk Logistics and their future vision.



# Planning Process

In order to fulfil all the transport requests, it is crucial for Jan de Rijk Logistics that their planning is efficient in terms of cost, service level and customer satisfaction. For more background, the planning process is first explained in more detail. Within the planning a distinction is made between full-truck load (FTL) and less-than truck load (LTL). Figure 1 shows the high-level transport planning process at Jan de Rijk Logistics.

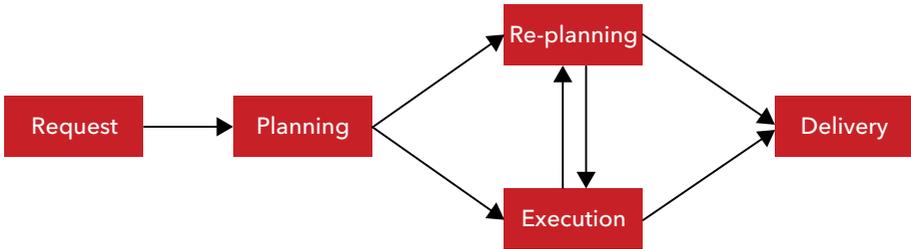


Figure 1: Planning Process

## REQUEST

The process starts with a transport request determined by an order entry through customer support desk (e.g. phone) or several Electronic Data Interchange (EDI) based channels via the JdR Advanced Anypoint Connector. The incoming requests are processed by the Transport Management System (TMS) which is connected to an Advanced Planning System (APS) called JPLEX (Jan de Rijk Planning, Execution and Scheduling). The available assets, the freight demand and the status of logistic activities are visible to the planners via JPLEX. Subsequently, the central planning department can start the actual planning process.

## PLANNING

Within JPLEX, the capacities of vehicles, trains and number of available drivers are known. During the planning process, route plans are designed. Planners attempt to assign available trucks to the requests while considering important KPI's of Jan de Rijk Logistics and calculate times (durations) for these route plans. In addition,

the planners are also responsible for determining a set of driver movement schedules for a set of loads during a given planning period. Driving time regulations constitute a major constraint, since drivers are only allowed to drive for a limited duration before they take a long rest. Eventually, the assignment will result in a planned route with estimated times for loading and unloading, departures and arrivals, connections to ferry, split shipment handlings and pulled unit changes.

Besides all the above, which applies to both FTL and LTL shipping, some issues related to LTL shipping further complicate the generation of efficient planning, and so it demands more attention during the design process of a route. LTL is usually used to transport multiple products in small volumes to multiple clients, thus the utilization of the unused capacity inside the trucks (in-vehicle consolidation) can increase truck utilization. However, it is not possible for every type of commodity to apply consolidation since, for example, hazardous materials should be transported separately from those that are non-hazardous.

The European regions in the international transportation group are divided among planners. These regions usually contain a country or a larger geographical area which allows planners to have visibility of all the demand requests in the area. In addition, each planner has visibility on available fleets in their region. Subsequently, planners have to explore all the available options and alternative routes in order to generate the most efficient load plans, in terms of cost, service level and customer satisfaction. Note that, whichever alternative is used, the cost of delivery depends on the distance that has to be travelled.

## **EXECUTION**

After designing the optimal route, planners remain responsible for the execution of the route. As each vehicle is equipped with a board computer, real time information is available for the FTL and LTL shipments. This information is updated continuously and used to keep track of the already calculated times based on the real time data. When recalculations between original and actual plan lead to inconsistent results, new decisions regarding the load plan have to be determined by the planners, which is also called re-planning.

## **RE-PLANNING**

During logistics or transport operations a lot of unexpected situations might occur. There are four general sources for these unexpected situation, namely human failures, exogenous factors (e.g. natural disasters or crime), endogenous factors (e.g. transport accidents, order cancelations or changes in quantity) or other events such as a customer refusing acceptance of the goods. All these sources lead to disruptions in the load plans and will come with increased costs and unmet service levels. If an unexpected situation occurs, it is the planner's responsibility to deal with this. At this moment, the planners mainly use their experience to cope with such situations and decide how to re-plan current and, subsequently, future situations.

## **DELIVERY/COMPLETION**

After the cargo has been delivered, JPLEXS is automatically updated and planners can assign new transport requests to the available assets. The last step for Jan de Rijk Logistics is to send an invoice for the transports that have been carried out.

# Improving Decision Support

Before a delivery can be completed, it is clear that planners are faced with many decisions during the process. JPLEXS supports the matching between trucks and trailers, as well as the matching of drivers to them. Anyhow, many other aspects that have a crucial role during the planning are not included in the system:

- Matching the truck with the right trailer.
- Consideration of travel time between locations.
- Decisions for the allocation of the driver(s) to the asset.
- Matching/Assignment of freight to the trailer.
- Decisions regarding empty running routes.
- Decisions regarding the assignment of shipments to third parties (i.e., charter).
- Decisions for the re-positioning of assets within the network.
- Decisions regarding the consolidation of small sized freight demands.

Figure 2 shows a screenshot of the support provided by the JPLEXS system. Since JPLEXS only provides real time information and very limited external constraints, almost all decisions listed need to be taken into account by the planners. Considering the frequencies of planned freight demands per day, decisions based on only experience can manifest as substantial cost driver for Jan de Rijk Logistics. In other words, the given that each planner needs to consider all different variables and then decide in a few minutes based on his or her experience asked for



Figure 2: JPLEXS

support. Therefore, Raoufi (2013) and Dimarelis (2014) both designed a decision support algorithm, which contain support for full-truck load (FTL) and less-than truck load (LTL) respectively.



# Decision Support Model for Full-Truck Load

Raoufi (2013) was the first to develop a decision support tool algorithm for the JPLeXS environment. His model was based on “Vehicle Allocation Problem” (VAP) model that was introduced by Giani (2004). This planning support model is developed to be applied by planners while planning full-truck load (FTL) freight requests. He expected the algorithm to have the highest impact on the performance of the international transportation group, which mainly transports full-truck loads. As a consequence, his study was aimed at examining the impact of scheduling while using real time information and the planning model on the performance.

The allocation model, also called VAPCI, that was designed in his research study proposes allocation decisions to the planners in order to get minimum costs for operation results. The solutions proposed are based on a detailed cost structure. VAPCI minimizes costs associated with decisions (e.g. empty running, hiring a charter or using own assets). Besides, the algorithm creates an interactive platform for the planners, so that for each freight demand the planners can define different scenarios and compare decisions to select the best one. The output suggests decisions regarding the use of own assets or hiring charters, and also empty running decisions considering the positioning of the assets in the network. The planner can repeat the algorithm several times to find the best alternative.

Table 1 shows an overview of the decisions that have to be made for every FTL freight request. In addition, it shows which tasks are performed by whom. The right column represents the new situation, after implementing the decision support tool. Compared to old situation, the planners are now supported properly when making most of the decisions. However, they do not have to change the way they used to work or perform extra activities as the algorithm mainly supports their decisions.

Decision for FTL freight requests	Planner		JPLEXS		VAPCI	
	OLD	NEW	OLD	NEW	OLD	NEW
Matching the truck with the right trailer.			X	X		
Matching driver(s) with truck and trailer.			X	X		
Consideration of travel time between locations.	X	X				X
Decisions for the allocation of the driver(s) to the asset.	X	X				X
Matching/Assignment of freight to the trailer.	X					X
Decisions regarding empty running routes.	X					X
Decisions regarding the assignment of shipments to third parties (i.e., charter)	X					X
Decisions for the re-positioning of assets within the network.	X					X

Table 1: Decisions for FTL freight requests, with situation OLD | NEW

Raoufi (2013) assessed the decision support model with real case experiments and proved a saving of on average 5.0% costs per full-truck load freight shipment and a total network saving of 12.9%. VAPCI proposes optimal decisions for multiple scenarios based on a detailed cost structure. These proposals serve as input for the planner in addition to their experience. As a consequence, the planner can make faster and more accurate decisions. Therefore, scheduling times reduce, and it thus leads to savings on the scheduling costs. Another and final saving is the fact that the decisions taken by the model aim to reduce empty kilometers which in turn results in a decreasing emission level.

# Decision Support Model for Less-than Truck Load

The decision support model designed by Raoufi (2013) only takes into account a part of the operations at Jan de Rijk Logistics. As already discussed, a distinction is made between full-truck load (FTL) and less-than truck load (LTL). Raoufi (2013) project focused on FTL, although the amount of LTL shipping accounts for about 65% of Jan de Rijk Logistics's total distribution operations. In addition, the utilization of assets consolidated from these LTL freight requests usually falls below the desired 80%. Therefore, Dimarelis (2014) continued at Jan de Rijk Logistics and developed a model focusing on this second kind of transportation, LTL. This model, implemented in the JPLEX, can offer rapid quality decisions during the planning process in order to improve the current situation.

Although, his goal was to design a model for LTL, he also further designed, and transformed the FTL model as proposed by Raoufi (2013). Additionally, a green extension, related to reduction of fuel consumption, was included in the objective function of the FTL model. Consequently, this resulted in two models, VAPCI-G which considers only FTL and, CDPHC that could be used for decisions regarding LTL freight requests. Both models retain the same working method for the planners. The planner selects a freight request in the JPLEX environment, and the algorithm proposes several decisions which can be chosen. The results of the decision support models delivered by Dimarelis (2014) are shown in Table 2. Again, it shows which tasks are performed by whom in both the old (left) and new (right) situation.

Decision for FTL freight requests	Planner		JPLEXS		VAPCI-G		CDPHC	
	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW
Matching the truck with the right trailer.			X	X				
Matching driver(s) with truck and trailer.			X	X				
Consideration of travel time between locations.	X	X				X		X
Decisions for the allocation of the driver(s) to the asset.	X	X				X		X
Matching/Assignment of freight to the trailer.	X					X		X
Decisions regarding empty running routes.	X					X		X
Decisions regarding the assignment of shipments to third parties (i.e., charter)	X					X		X
Decisions for the re-positioning of assets within the network.	X					X		X
Reduction of fuel consumption						X		

Table 2: Decisions for FTL (VAPCI-G) and LTL (CDPHC) freight requests, with situation OLD | NEW

In particular, VAPCI-G manages to attain cost savings of about 16% which can be seen as a major improvement to the model of Raoufi (2013). The case study of Dimarelis (2014) also showed that the CDPHC model proved a saving in costs of on average 14%. The models can offer, when implemented, high quality of decisions, minimizing simultaneously costs and planning time. On the other hand, higher service levels could be delivered, leading to increased satisfaction of the customer. The utilization of assets can be increased by avoiding empty or near empty running. In some cases, the planner's utilization reached 69%, allowing trucks to drive semi filled. Nonetheless, lower emission levels could be obtained for Jan de Rijk Logistics by applying not only VAPCI-G but also CDPHC, since the last one's target is the minimization of trucks used in the network leading to lower levels of emissions as well.

# Charter Selector

The decision support models concerning full-truck load (FTL) and less-than truck load (LTL) also propose decisions regarding the use of own assets or hiring charters. The process of hiring a charter has made some developments over the past years. Frequently, the planner needs more capacity than the capacity provided by Jan de Rijk Logistic's own assets or cannot use own assets for various reasons, such as the asset not being close enough to the origin of a transportation order. Back in the days, one had to pick up the phone to call different third parties and ask them if they had capacity available and at what price. However, nowadays Jan de Rijk Logistics makes use of the so called "charter selector". This algorithm, developed by Van Vught (2013), makes information available about the prices and possible types of charters and thus supports the planner in making the right decision. The tool will solve internal communication issues and allows for monitoring the performance of the planner which positively influences the operation margin. Additionally, all price information is stored and allows for standardization of prices for Jan de Rijk Logistics. Third parties are, as a consequence, not able to ask high prices anymore. Finally, the charter selector makes it possible to filter and sort charters based on a combination of price and quality, while the old model only filters on quality.

Together with the decision support algorithms of Raoufi (2013) and Dimarelis (2014), this charter selector designed by Van Vught (2013) ensures even faster decision times. When all three are integrated in JPLEXS, the planner can indicate which parameters are required. So, for example, should the system propose several decisions only including own assets, or are external assets (i.e. charters) also allowed? This parameter and others result in better process planning. Hence, the planner always makes the final decision and sends the chosen planning to the driver.

## Impact at Jan de Rijk Logistics

The projects conducted in collaboration with Eindhoven University of Technology (TU/e) have contributed to the planning process at Jan de Rijk Logistics. The decision support algorithms designed by Raoufi (2013) and Dimarelis (2014) and the charter selector of Van Vught (2013) showed promising results such as saving on scheduling cost, reduction of the planning time, emission level reduction (by avoiding unnecessary empty running), and even better allocation decisions when applying case studies.

After implementing, Jan de Rijk Logistics perceived great benefits from the decision suggestions by the algorithm for both full-truck load (FTL) and less-than truck load (LTL). The JPLEXS system has become smarter and better applicable. Nowadays, planners are able to consider various scenarios before making a final decision and plan the optimal combination of asset, driver and route. These various scenarios can be evaluated in a shorter time span than the original self-oriented decision. Therefore, the desired reduction in planning time is realized and thus found as very valuable for the organization. Where planners previously could only follow 50 assets without any assistance, it is now possible to keep track of 100 to 120 assets with the support of the models implemented. A slight improvement in the quality of planned freight requests was also noted. Subsequently, because of the faster planning time and more efficient planning less trucks are needed. Consequently, fewer empty runs are needed and, therefore, the emissions decrease which is one of the sustainability initiatives from Jan de Rijk Logistics. Altogether, Jan de Rijk Logistics feels that their planning is more efficient in terms of cost, service level and in the end customer satisfaction thanks to the implemented algorithms of Raoufi (2013), Dimarelis (2014) and Van Vught (2013).

## A Future Vision

In order to finalize the current planning process, Jan de Rijk's ultimate goal is that no phone calls have to be made for hiring a charter. The third parties' capacity should be integrated in their JPLEXS and lead to even more optimal planning. The region-based way of business and continuous distribution planning makes it complex to produce an optimal algorithm.

However, as the current planning process goes near optimal, the next step is to be concerned with a tactical planning instead of only an optimal. In that case, the planners do not have to be busy with the present but can start looking forward in time. That way, it is known what the near future will bring, and potential problems can be prevented instead of being solved afterwards. Forecasting and predictive analysis can be of added value here as there is lots of data available. Nevertheless, the planner will keep making final decisions in the end. Though, owning more valuable information can always lead to better decisions and Jan de Rijk Logistics looks forward to meeting these challenges.



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## COLOFON

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### **Editorial**

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