The client

The client is a North-American petrochemicals division of an oil and gas supermajor, a business with multi-billion-dollar annual revenues. It has launched an ambitious worldwide program to double the division's business within the decade, while increasing profitability and return levels.

After an assessment of the client's global operations, the North-American distribution network has been identified as one area where profitability and customer service levels could be significantly increased. The operations departments are responsible for the safe transport of approximately 30,000 shipments that deliver over 10 million tons of chemicals to customers annually. This is accomplished through a vast network of distribution channels, spanning various modes of transportation from rail and truck to barge.

The challenge

The petrochemicals industry is undergoing a variety of competitive and regulatory developments that are making the management of logistics and distribution increasingly complex:

- Continued M&A activities in different markets require the consolidation and integration of multiple supply chain networks;

- Scarcity of expertise limits organizations to deal with complex supply chain configurations;

- High volatility in the rail freight market (e.g. due to the recent US boom in shale gas), the limited availability of railcars and a rail infrastructure that leaves customers with little leverage to negotiate lower rates;

- Enhanced federal safety regulations that result in additional transport costs.

These developments are only adding to the existing challenges inherent to managing transport costs in complex logistics networks. There is a large gap between top and bottom performers in this area. According to APQC, top performers on average spend less than $10 to operate outbound logistics for each $1,000 of revenue, whereas bottom performers spend more than five times as much. This gap demonstrates that potential savings in this area could make a huge difference in the client's low-margin commodity business. However, because the increasing complexity of the industry obscures end-to-end visibility into logistics costs, companies have difficulty in identifying the best ways to control and reduce these costs effectively.

The lack of end-to-end visibility into logistics operations and costs also led to challenges within the client's organization. Decision-making within the supply chain was compartmentalized and managing transports required a lot of day-to-day adjustments and troubleshooting. This lack of visibility also contributed to misalignment and finger-pointing between the commercial, supply and logistics departments, and inconsistencies between their views on the network's capabilities and requirements. Moreover, various businesses in the client's organization all claimed that a lack of railcar capacity caused them to miss out on customer orders. This put great pressure on the central planning group that allocates available railcars to the businesses. It also created pressure to invest in more railcars.

With no shared vision between the departments, there was no framework in place to collectively improve the way the logistics network was run.

Total cost to operate outbound logistics per $ 1,000 revenue

Top Performers	$ 9.48
Median	$ 25.07
Bottom Performers	$ 51.78

$ 0 $ 20 $ 40 $ 60
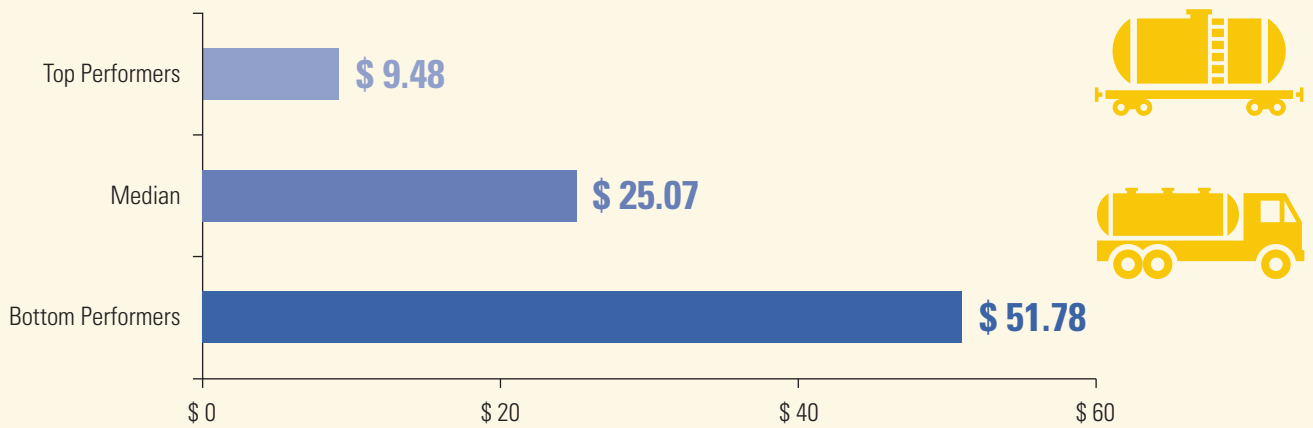
Bottom performers spend more than five times as much to operate outbound logistics than top performing organizations

The approach

A multi-step approach was followed to enable the client to reduce its logistics costs while maintaining sufficient performance and flexibility in its supply chain.

Network optimization:

Central to our approach is the network optimization stage, in which a strategic view is taken on how improvements in transport and logistics management can create a positive business impact. Network optimization can help organizations create new competitive advantages, enhance profitability, improve network asset utilization and support future growth. See illustration below.

The network optimization stage also paves the way for improvements in a number of operational logistics processes:

- **Supply planning:** establishing safety and target stock levels and optimizing actual stock levels based on expected customer-demand profiles; reducing suboptimal sourcing and routing decisions and eliminating excess product movement through the network;

- **Logistics asset planning:** proactively determining the optimal allocation of railcars to network locations, thereby reducing cancelled orders due to a lack of railcar availability and empty railcar movements, as well as improving railcar utilization;

- **Railcar fleet-sizing:** calculating the actual and forecast future number of railcars needed to fulfill actual and expected customer orders.
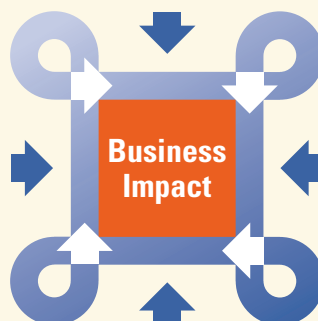
In the remainder of this case study, we will discuss the network optimization and the railcar fleet-sizing parts of our approach in more detail.

Create competitive advantages

- Network analysis clarifies trade-offs and opportunities of potential supply chain configurations in terms of costs and customer service

Improve network asset utilization

- Optimization has a direct impact on capital requirements for facility network development
  - Additional distribution facilities can easily cost millions to put in place
  - Reduction in railcar fleet size due to optimal routing

Business Impact

Enhance profitability

- Optimization typically leads to 5%-10% net annual savings in total logistics operating costs, impacting:
  - Transport costs
  - Fixed facility costs
  - Variable handling costs
  - Terminal productivity increases resulting from 'right-sizing'

Support future growth

- Network analysis secures future performance of the supply chain given volatility in demand and throughput

A. Network optimization

The network optimization methodology focuses on capturing a multitude of supply chain variables from the previous 12 months in order to accurately depict and simulate the current state of the network operations. KPMG uses ILOG LogicNet Plus, IBM's highly sophisticated network optimization software, to model and optimize client networks. This process is referred to as 'developing the baseline'.

In order to build and validate the baseline model, we accurately determine the total landed cost of customers, revealing the true cost of serving them, based on sourcing and logistics decisions. This in-depth modelling process helps to enhance end-to-end cost visibility across the supply chain and enables clients to understand decisions based on both the obvious and the hidden costs associated with product movement.
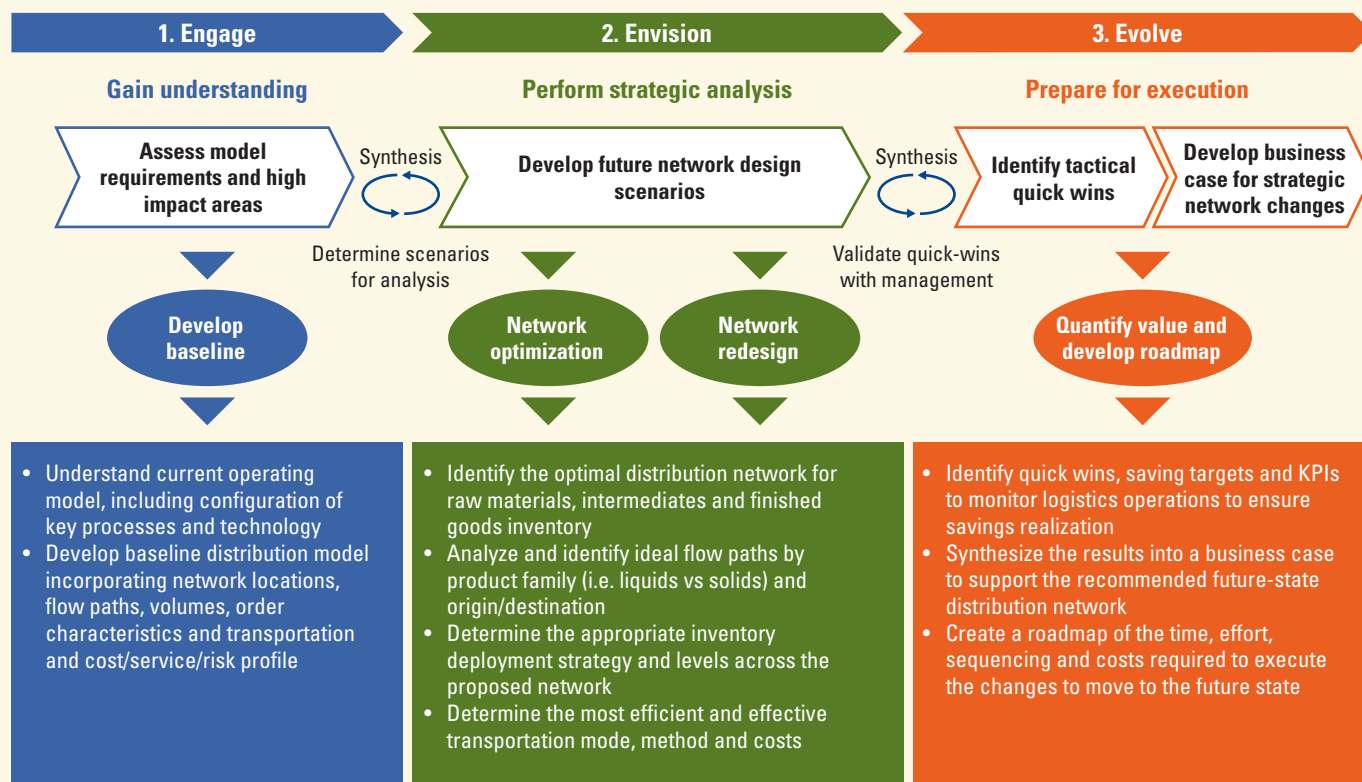
Creating this fact-based depiction of current network operations often reveals a number of quick wins. In this case, these included:

- Elimination of lane duplication - reducing costs by eliminating duplicate lanes servicing the same ship-to-customer locations;

- Reduction in stock levels - reducing costs by lowering the volume of product shipped throughout the network in order to meet established stock targets and anticipated customer demand;

- Optimal lane selection - changing routes to start from optimal source locations, based on reduced mileage and transport costs.

Establishing the baseline model also creates a reference that enables clients to simulate the incremental benefits of different network configurations. For example, what effect would opening a new terminal have on service levels and costs? Such simulations may help clients to redesign their distribution networks, should the business strategy or customer demand patterns change.

A high-level overview of the process followed in the network optimization stage is provided on the next page.

1. Engage	2. Envision	3. Evolve
Gain understanding	**Perform strategic analysis**	**Prepare for execution**

Assess model requirements and high impact areas → Synthesis → **Develop future network design scenarios** → Synthesis → **Identify tactical quick wins** | **Develop business case for strategic network changes**

Determine scenarios for analysis

Validate quick-wins with management

Develop baseline

Network optimization

Network redesign

Quantify value and develop roadmap

- Understand current operating model, including configuration of key processes and technology
- Develop baseline distribution model incorporating network locations, flow paths, volumes, order characteristics and transportation and cost/service/risk profile

- Identify the optimal distribution network for raw materials, intermediates and finished goods inventory
- Analyze and identify ideal flow paths by product family (i.e. liquids vs solids) and origin/destination
- Determine the appropriate inventory deployment strategy and levels across the proposed network
- Determine the most efficient and effective transportation mode, method and costs

- Identify quick wins, saving targets and KPIs to monitor logistics operations to ensure savings realization
- Synthesize the results into a business case to support the recommended future-state distribution network
- Create a roadmap of the time, effort, sequencing and costs required to execute the changes to move to the future state

Results

The network optimization stage yielded multiple results. On a strategic level, it resulted in a validated baseline model of the client's logistics network that will serve as a starting point for any future improvements and modifications required to meet the client's business goals.

On an operational level, it points to low-hanging fruit such as the quick wins described earlier. In this case, the client was able to achieve an estimated 5% cost reduction within the first few months of the project.

Within the client organization, the network optimization phase greatly contributed to driving the conversation between the functional groups involved by quantifying the issues and providing an objective overview. For example, during the network optimization of one business line, costs were modelled in an automated Excel file that allowed the sales department to play with the numbers and get a feel for the sensitivity of various parameters. This resulted in a much-improved bargaining position as they now knew exactly what to push for in negotiations in order to achieve their business targets.

B. Railcar fleet-sizing

As rail transport accounts for the majority of the client's shipments and given the specific challenges in the rail freight market (see page 2), in the final part of this case study we will focus on the correct sizing of the client's railcar fleet. The client uses approximately 4,000 railcars, both owned and leased.

The railcar fleet-sizing process aims to calculate the optimal number of railcars needed to transport product to each customer location. A key input parameter for this process is the railcar cycle time – the time needed to complete a round-trip from the point of origin to the customer location and back.

Two of the stages in this railcar cycle, i.e. the transit times to and from the customer, are dictated by distance and railroad efficiency and hence are mostly outside the client's control. However, the other stages, i.e. the dwell-times at the point of origin and hold-times at customer locations, do provide an opportunity for improvement by the client. See railcar cycle infographic on page 7.
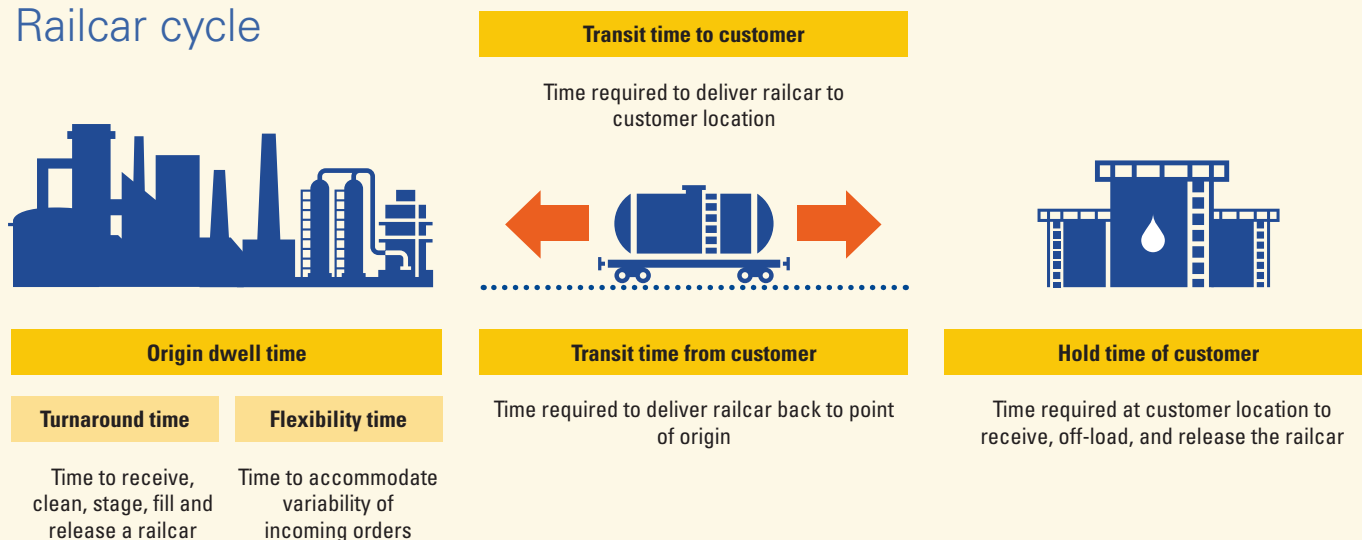
Previously, historical averages for throughput times at these locations had been taken as a given in the railcar fleet-sizing process. Not only did this use of historical averages introduce large errors into the perceived number of railcars required, it also left the client without a reference against which to monitor and improve these throughput times.

A conceptual improvement in the railcar fleet-sizing process was made by splitting the time spent at the origin into two separate stages: the turnaround time (time needed to actually receive, clean, fill, stage and release a railcar) and the flexibility time (time needed to accommodate the variability of incoming orders).

In addition, appropriate target times were introduced for the stages that the client can control. Meeting these targets required a more proactive management of rail transport e.g. monitoring cycle times and adjust in time to avoid delays, which has improved the accuracy of the fleet size calculations.

Recommendation to alter railcar cycle stages to include a turnaround and flexibility time

Railcar cycle

Transit time to customer

Time required to deliver railcar to customer location

Origin dwell time

Turnaround time

Time to receive, clean, stage, fill and release a railcar

Flexibility time

Time to accommodate variability of incoming orders

Transit time from customer

Time required to deliver railcar back to point of origin

Hold time of customer

Time required at customer location to receive, off-load, and release the railcar

---

Current railcar cycle consists of four stages:

1. Transit time to customer   2. Hold-time at customer   3. Transit time from customer   4. Origin dwell time

The railcar fleet sizing calculation can be optimized by separating the Origin dwell time into a Turnaround time, and a Flexibility time:

• Turnaround time includes the time to receive, clean, fill, stage, and release a railcar at point of origin.
• Flexibility time includes the time to accommodate the variability of incoming orders which has implications for service levels, Increased flexibility time will potentially reduce rejected orders due to railcar availability but will increase fleet costs.

Results

We were able to introduce a model to determine the actual railcar cycle times to use in a proper fleet-sizing calculation. Using this model, we helped create a data-driven, validated and consistent fleet-sizing calculation process that brought to light the fact that the client already had sufficient railcars to support its business. This insight helped to eliminate and/or postpone the purchase or lease of an additional 400 railcars that had previously been thought necessary.

Authors

Haijo Kampinga
Director, Operations Strategy Group
KPMG
kampinga.haijo@kpmg.nl
Tel: +31206 568504

Chris Wren
Director, Customer and Operations
KPMG
cwren@kpmg.com
Tel: +1 214 840 8209

Daniel Papas
Manager, Customer and Operations
KPMG
dpapas@kpmg.com
Tel: +1 239 665 2861

David Rikkengaa
Senior Consultant, Operations Strategy Group
KPMG
rikkengaa.david@kpmg.nl
Tel: +31206 567216

www.kpmg.com/nl