4FLOW
Your supply chain solution

The ultimate guide to transportation and load building optimization

How to improve transportation efficiency with a new approach to material planning

Contents

Introduction

Transportation has a direct effect on a business's profitability. With transportation costs accounting for an average of 60%[1] of logistics costs globally, savings in this area can have a significant impact on supply chain costs – and a business's bottom line.

The cost of transportation is based on various factors such as fuel prices, labor costs and government regulations on emissions. Efficient transportation that maximizes utilization of resources empowers businesses to reduce transportation costs and improve their supply chains' performance.

Yet implementing transportation optimization processes is easier said than done. Increasing supply chain complexity and the high number of relevant variables, like weather conditions, increasing fuel prices, and capacity and labor shortages, are significant challenges.

Technology-driven solutions that can connect and exchange data between different processes help solve these challenges. Connectivity and visibility are key to ensuring cost-optimal results while maintaining peak performance and quality.

This e-book will introduce you to the benefits of integrating transportation optimization earlier in your supply chain processes, specifically in the material planning phase, with the help of specialized transportation planning software. The e-book will also highlight what you need to consider before implementing this kind of advanced planning and walk you through each step. As a result, you can expect to improve efficiency and achieve cost savings in your supply chain.

1 Global Logistics Costs by Function and Mode 2018

What are today's most critical challenges in supply chain planning?

Today's supply chains need to navigate a VUCA landscape – that is, a operating environment characterized by volatility, uncertainty, complexity and ambiguity. Changes happen quickly, and supply chains need to react with agility to maintain service levels. At the same time, competition is high, and meeting customer expectations in the most cost-effective way is more important than ever.

Let's take a closer look at some key challenges facing supply chains today:

Material shortages

Even today, years after the outbreak of the Covid-19 pandemic, material shortages continue to affect industries across the globe, from automotive to consumer goods to pharmaceuticals. Many production and manufacturing businesses had to reduce their output, leading to shortages of various materials. This created significant supply chain disruptions like delays or production stops. As a result, prices for goods have gone up as businesses compete for limited quantities, and many businesses are not able to meet full customer demand.

Competitive market

With growing customer demands, product personalization and the expectation of faster deliveries, it is becoming harder for businesses to keep up with the expectations of the market while staying cost-effective. To remain competitive, businesses need to focus on capacity planning, process optimization, transparency and efficiency.

Demand fluctuation

Consumer attitudes and behavior are changing fast, and forecasting their service expectations and overall demand is not easy. Many businesses struggle to accurately forecast inventory requirements, leading to understocking or overstocking of products. In contrast, an agile supply chain can handle last-minute changes in demand and fluctuating volumes, in addition to reacting to changing demand forecasts.

Increasing freight costs

In cases of material shortages, freight costs often rise as businesses rely on expedited shipping or suppliers from further away. On top of that, as the demand for goods rises, so does the demand for transportation. However, due to limited capacity and higher fuel costs, carriers need to increase their rates to cover operational costs. Against this background, reduction of transportation costs is becoming more and more critical for businesses to stay competitive.

Labor shortages

On top of material shortages, labor shortages are becoming increasingly critical. Recruiting and retaining qualified workers remains a top challenge for supply chain executives. Understaffed factories can cause production slowdowns and inventory stock-outs, for instance. Labor shortages among carriers cause increasing transportation costs and delays in delivery.

Planning silos

Departments across the supply chain traditionally have their own objectives, causing them to plan and act independently. This lack of communication and collaboration leads to inefficiency in the supply chain and ultimately impacts the business's overall performance. Businesses can eliminate silos by implementing cross-functional planning and optimizing planning processes.

How can transportation planning help businesses overcome today's supply chain challenges?

Operational transportation planning determines which items will travel a particular route with which vehicle and carrier, and when. This process is key to a well-functioning supply chain, as it empowers businesses to meet customer demand and improve profitability.

Today's challenging market means transportation planners need to ensure maximum delivery performance at the lowest cost. A critical component of this process is load building – consolidating multiple orders into a single load so these goods can be transported more efficiently.

Load building is often done manually, but specialized software helps consider factors like order quantities, product dimensions and transportation capacity to create an optimal shipment plan. Effective load building can help reduce transportation costs, streamline distribution and improve overall supply chain efficiency.

Businesses that integrate transportation optimization with load building in their supply chain processes gain a competitive advantage in the market, as they can distribute goods as quickly as possible at the lowest possible price while avoiding exceptions like damages, delays or losses.

What is the goal of transportation planning?

Integrate real-world transportation factors

> Automatically consider transportation constraints in your planning
E.g., product incompatibilities, capacities or schedules

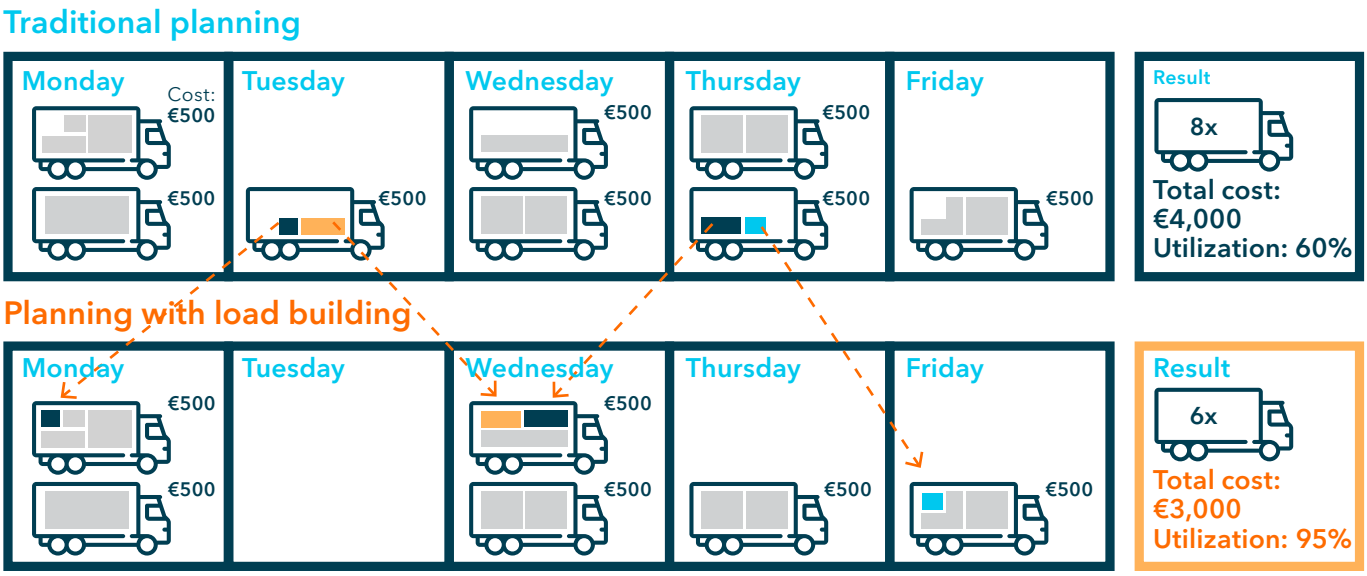
Get an optimal shipment plan

> Consolidate your shipments based on transportation factors
> Prepone or postpone your call-offs and maximize your truck utilization

Use an actionable, reliable plan for greater cost savings

> Reduce transportation costs by consolidating orders and maximizing utilization
> Make sure the right products are delivered at the right time, in the right quantities and at the lowest cost

What are the benefits of load building in transportation planning?



Integrating load building into transportation planning lets businesses consolidate orders into more efficient shipments and reduce transportation costs.

Within transportation, load building is an important lever for a resilient and cost-efficient supply chain. Some tangible benefits of this transportation optimization measure include:

Cost reduction

Transportation can account for a significant portion of total logistics costs. Load building reduces costs by finding the most efficient schedule and means of transportation with a focus on maximizing utilization. In turn, higher utilization means fewer trucks are needed – which further helps reduce transportation costs. Depending on the industry, transportation makes up 30-60% of overall costs, so savings in this area can have a great impact on the business revenue.

Maximized utilization

Many trucks travel at less than full capacity. By bundling orders in fewer shipments, load building maximizes businesses' utilization of transportation assets. Transportation optimization boosts productivity by ensuring that trucks are used to their full capacity, reducing idle time and improving overall transportation efficiency. Effective optimization can also lead to cost savings by reducing transportation frequency and the amount of unused capacity.

Improved sustainability

Optimizing the number of vehicles as well as loads and their weight reduces the number of trips and increases capacity utilization, which directly reduces carbon emissions.

Increased supply chain and planning efficiency

Transportation planning and optimization support early communication across functions to reduce inefficiencies related to unrealistic planning. This approach ensures that the right products are delivered at the right time, in the right quantities and at the right cost – so businesses can meet customer expectations and maintain optimal levels of inventory. Efficient transportation planning helps companies reduce costs, minimize waste, improve customer satisfaction and gain a competitive advantage in the marketplace.

Overall, transportation optimization is essential to improving supply chain efficiency, reducing costs and improving customer satisfaction.

How does transportation planning fit into supply chain processes?

Conventionally, transportation planning is part of the operational planning stage of supply chain processes and and takes place after material planning has been completed.

Before transportation can be executed, the supply chain manager must determine the mode of transportation to be used, the routes to be taken and the carriers to be engaged. This decision is based on factors such as transportation volumes, frequencies, product parameters like refrigeration requirements or size, the distance to be covered, delivery timelines and cost.

These decisions about modes, routes and carriers form the basis for transportation planning.

Once the transportation planning process is complete, the logistics team executes the plan by coordinating with carriers, arranging for any necessary permits and ensuring that the products are loaded and shipped as planned. During the transportation process, the logistics team tracks the cargo to ensure that it arrives at the destination on time and safely.
After the transportation process, the logistics team reviews the performance of the carriers, including the rate of on-time delivery, the costs incurred and any issues encountered. This information is used to continuously improve the transportation planning process.

These planning and coordination steps are time critical. In fact, most transportation planning decisions must be made and potentially adjusted only hours before the carrier pick-up. Even though orders are planned days before the actual final delivery, depending on the lead time, the pick-up schedule must be shared with the carrier much earlier. This leaves only a couple of hours to make changes to the transportation plan.

Those who work in transportation execution know that there are numerous reasons why last-minute changes can happen before the carrier pick-up. Some of the most common are:

Changes in inventory levels that require changes in the transportation arrangements

Unforeseen disruptions such as traffic, weather conditions or road closures that cause cancelations or delays

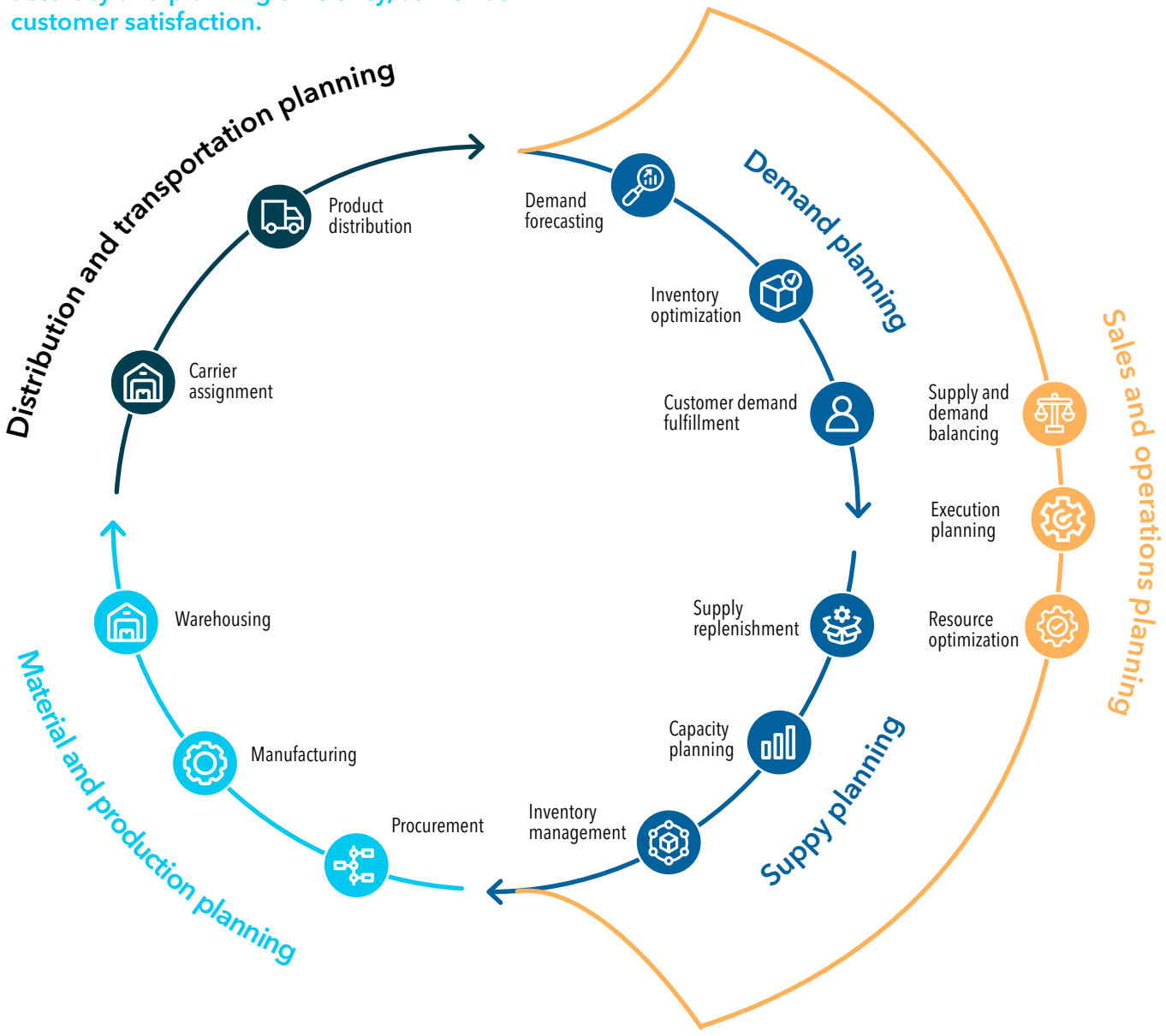
Changes in customer demand that require changes in delivery schedules or quantities

Changes in carrier availability or capacity that require a different mode of transportation or rerouting

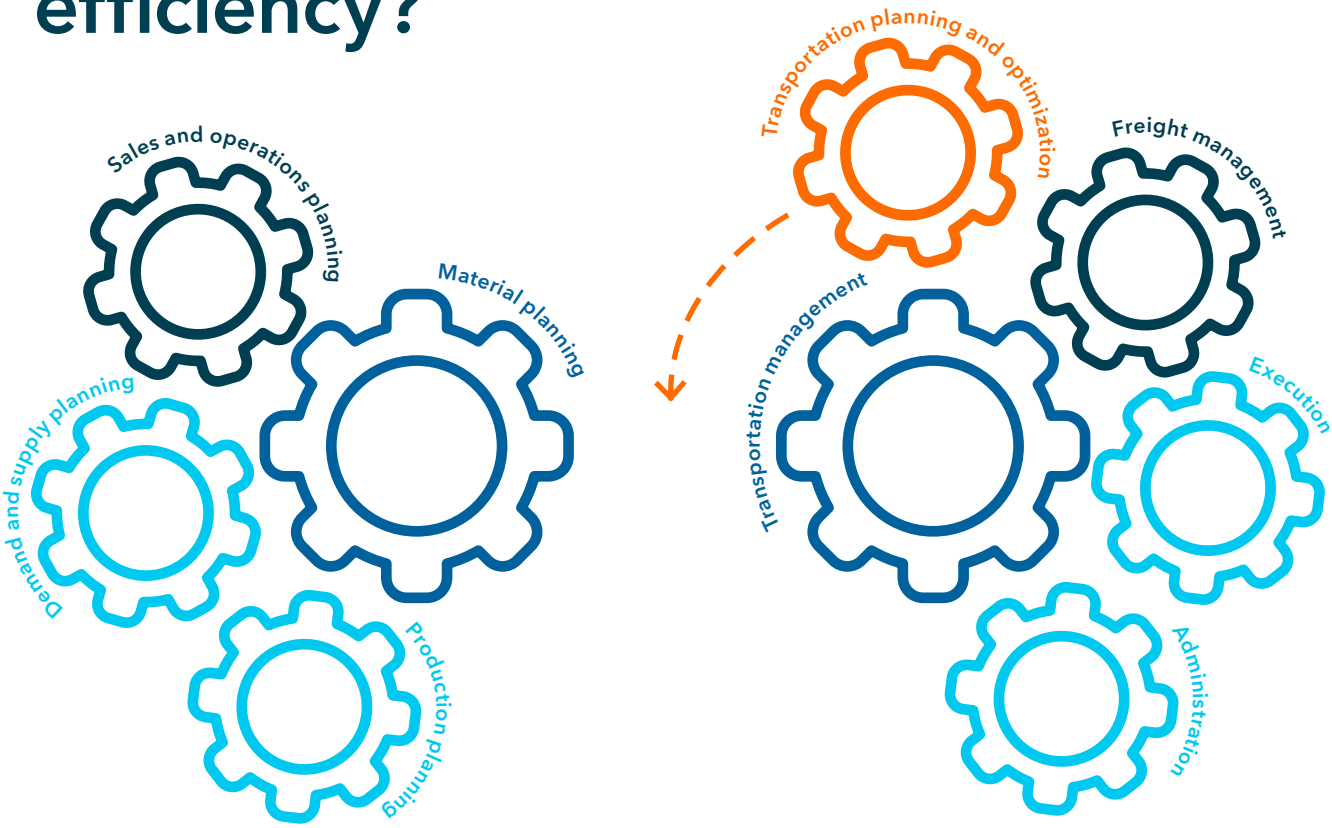
The consequences of short-term changes are significant. Among the most obvious are delays and shipment failures, which can disrupt the entire supply chain network. Shipping failures can cause additional costs, for instance for expedited shipping. Short-term changes can also bring higher risks of error. To ensure on-time delivery, goods are sometimes transported inappropriately – for instance, at the wrong temperature or without observing the proper safety precautions for dangerous goods. Incorrect delivery and damaged or otherwise compromised goods reduce customer dissatisfaction. Lastly, delays raise the cost of transportation planning and execution, as administrators and carriers must spend more time managing unexpected changes and disruptions.

Greater transparency over these changes early on mitigates many of these negative consequences. If transportation planners are aware of inventory levels and material availability, for instance, they can make more realistic plans. The benefits increase further if material planners are also aware of transportation optimization potential and shipping constraints during the material planning phase.

Aligned and concurrent supply chain planning processes help businesses improve forecast accuracy and planning efficiency, as well as customer satisfaction.



How does optimized transportation planning connect material planning and transportation for greater efficiency?



Eliminating silos between material planning and transportation planning ensures feasible planning and smoother supply chain operations.

Conventionally, material planning and transportation are two separate worlds. Material planners traditionally have no visibility on real-world transportation constraints such as transportation capacity, plant or distribution center schedules or equipment restrictions, i.e., for dangerous goods.

The opposite is also true: transportation planners have no visibility on the impact of their plans on inventory levels or material availability. This can cause several of the inefficiencies mentioned in the previous chapter.

Eliminating these silos and considering transportation factors earlier in planning processes offers significant benefits. The integration of transportation in the actual material planning phase, instead of only in the execution, means changes to reflect real conditions can be made earlier, before the scheduling agreements are set.

As a result, businesses have more flexibility for planning and optimization. Thanks to load building optimization, for instance, they can maximize the utilization of individual shipments. Integrated planning also ensures the production plan is actionable: materials and products can be shipped on the planned date because real-world schedules and capacities are considered beforehand.

In material planning, real transportation constraints like schedules, capacity and incompatibilities can be considered along with inventory levels. This avoids last-minute changes and costly back-and-forth communication to correct plans that are not feasible.

Integrating transportation optimization into the material planning phase thus eliminates silos between these traditionally separate but crucial areas of the supply chain. With this, businesses increase the efficiency and overall quality of their planning – and achieve significant cost savings.

What kind of software support is available for optimizing transportation plans? Is it compatible with a TMS?

What is a transportation management system (TMS)?

A transportation management system or TMS is a software that supports the end-to-end movement of both inbound and outbound goods, including planning, execution and optimization. Functions could include freight management, order execution, shipment tracking, communication with carriers and documentation of these processes. By providing visibility over daily operations, a TMS can also help businesses ensure their shipments are delivered on time and comply with relevant regulations.

Key functions of a TMS

Planning
- > Optimization of routes, carriers, loads and orders
- > Analytics and reporting
- > Performance management

Freight management
- > Carrier rates
- > Contract management
- > Order management
- > Multimodal transportation

Execution
- > Booking
- > Tracking
- > Real-time visibility
- > Communication

Administration
- > Billing
- > Payment
- > Settlement
- > Auditing

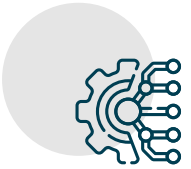
What is a transportation planning system?

Transportation planning software connects transportation planning with material planning to optimize transportation plans with respect to their effect on inventory. Transportation factors are considered in an early stage during the material planning. In this way, call-offs are planned and optimized given real-world transportation parameters, the bill of materials (BOM) and inventory levels. This approach ensures more reliable and actionable planning.

Key functions of transportation planning systems

Connect transportation and material planning

> Optimize your material call-offs considering transportation constraints
> Eliminate silos for greater planning efficiency
> Get total transparency and review the optimized results



Optimize shipments

> Pre- and postpone shipments to create fuller loads while maintaining optimal inventory levels
> Get actionable planning results based on real-world parameters
> Reduce demand for transportation

Review and track your results

> Compare most relevant KPIs before and after optimization
> Track and evaluate metrics like CO_2 emissions and cost savings
> Get full reports on improvement

What are the differences between a TMS and a transportation planning system?

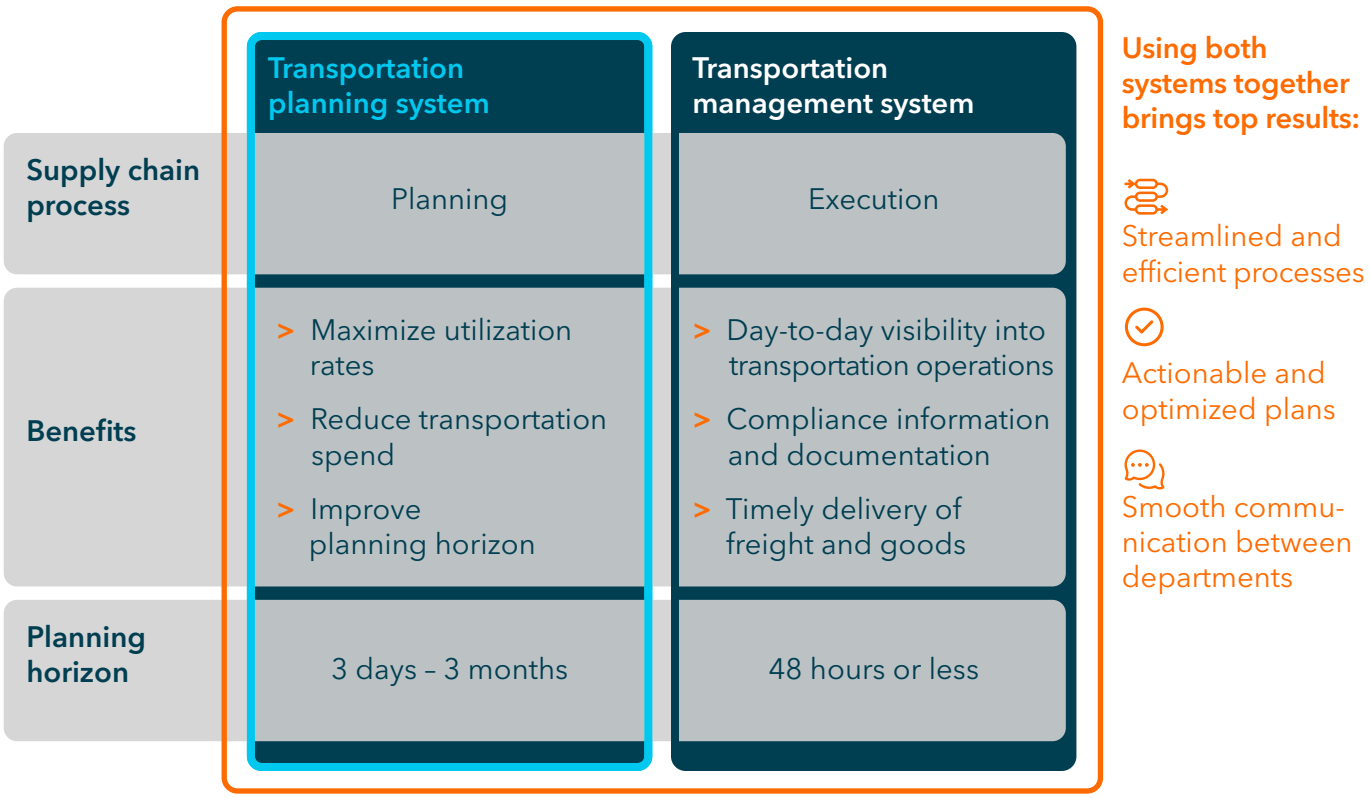
While both kinds of software support businesses with transportation, a transportation planning system and a TMS have different uses and operate with different planning horizons. A transportation planning system is a planning software with an optimization horizon ranging from 3 days to 3 months, depending on the business's requirements. A TMS is an execution software that typically operates in a very short window of time, the next 24 to 48 hours.

The benefits of these two systems are different, as well. A TMS enhances day-to-day visibility, assists with compliance, provides documentation and supports the timely delivery of goods. On the other hand, a transportation planning system focuses on load building and optimization to maximize utilization, reduce transportation costs and improve planning efficiency.

Another critical difference between the two kinds of software is optimization capability. A TMS can only optimize known transportation factors. It receives the orders from the ERP system just a few days before the actual delivery. A TMS has no visibility on the impact of transportation on inventory levels, and it provides no information on material availability to transportation planners, so they do not know if there are any execution conflicts.

A transportation planning system can automatically optimize transportation during planning. It optimizes material call-offs considering both inventory and transportation constraints, allowing planners to consider transportation factors and material constraints simultaneously.

Differences between a TMS and a transportation planning system



Transportation planning systems and transportation management systems (TMS) have different functionalities – meaning businesses can use either kind of software individually or both together for even smoother operations.

How can a transportation planning system enhance a TMS?

Considering transportation planning and optimization already in the material planning phase makes planning more flexible and efficient.

These advantages begin with full visibility. Material planners have a better overview of the supply chain and understand the impact of their work on execution, empowering them to make actionable plans that are aligned with actual transportation conditions. At the same time, transportation planners are aware of inventory levels and material availability and can make plans accordingly. This integrated, transparent process eliminates silos and allows businesses to increase planning efficiency.

Integrated planning makes it possible to share relevant information with stakeholders early and often. For instance, businesses can share planning information with the carrier base prior to load tendering. This can help ease the capacity constraints that we see in the transportation market and even help reduce costs on a rate basis thanks to this advance preview.

Similarly, within a business, earlier planning means any changes can be adopted before the plans are communicated – preventing back-and-forth communication for last-minute changes. In both cases, the flexibility afforded by early planning boosts planning efficiency.

Implementing a transportation planning system alongside a TMS enables smoother execution by ensuring actionable plans, maximizing utilization and minimizing inefficiencies like last-minute changes and back-and-forth communication.

With these time advantages, businesses can save costs and improve their overall planning and processes efficiency.

How does a transportation planning system work? What kinds of factors are considered?

A transportation planning system automatically runs an additional optimization in the demand planning calculation. It prepones and/or postpones orders to consolidate demand and create fuller, more efficient loads. Transportation and inventory constraints are considered simultaneously, so planning results are feasible and cost-efficient, and material arrives on time.

The software's algorithms are based on real-world constraints, including freight rates and current transportation capacities, to provide users with actionable planning results. This significantly reduces the need for manual adjustments when creating shipments.

Depending on the specific industry, processes and customer requirements, different transportation factors need to be considered in the optimization. Some of the most common parameters are discussed below.

Transportation capacity

Transportation capacities in terms of volume, weight and required floor space (measured as loading meters in Europe) must be considered in the optimization to make sure that materials and products fit in the planned vehicle during the execution.

Freight agreements

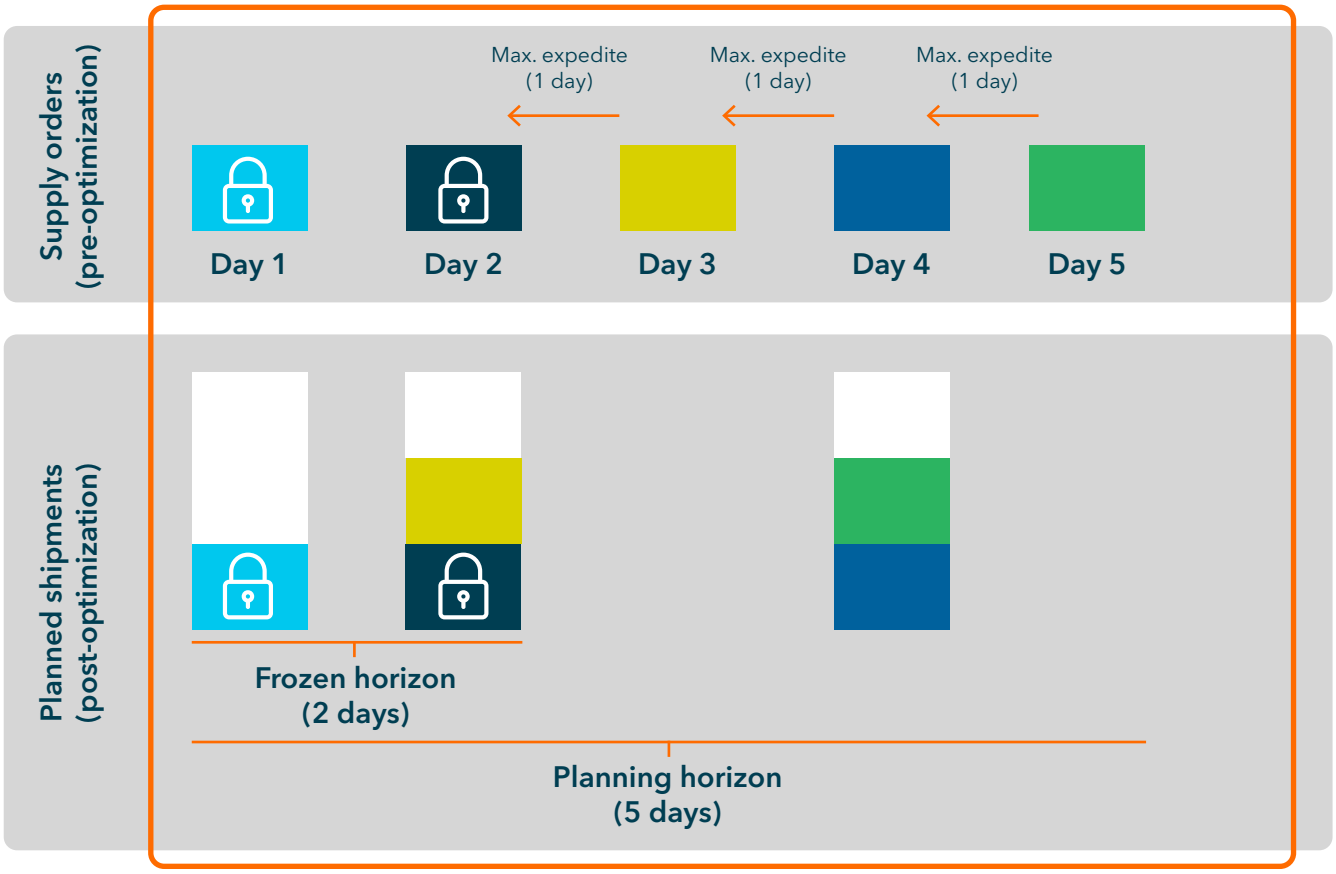
During the optimization, all available freight agreements can be considered to achieve cost-optimal results. Using the agreed-upon rates and means of transportation, the optimization can forecast transportation costs and propose the cost-optimal solution.

Inventory considerations

Considering inventory level and material availability ensures the material can be picked up and shipped. It also guarantees that supply and demand inventory levels remain within an acceptable range.

Planning horizon, frozen horizon and maximum expedite

To ensure reliable planning, different horizons should be considered. These include the planning horizon – the timeframe in which orders can be rescheduled – and the frozen horizon – the timeframe in which the orders cannot be rescheduled. The maximum expedite, another key timeframe to consider, is the maximum number of days an order can be preponed.



The planning horizon, frozen horizon and maximum expedite are key parameters for optimizing transportation schedules.

Storage capacity

This parameter refers to the utilization of a warehouse. If a warehouse is almost full on a certain day, demands cannot be preponed to this day to avoid exceeding capacity.

Incompatibilities

Incompatibilities should be considered in the optimization so different equipment can be used for products that cannot be shipped together – for example, dangerous goods or products that require different temperatures.

Handling unit constraints

Considering handling unit dimensions and stacking factors helps maximize pallet capacity by creating mixed pallets.

Maximum postponement

If orders can be postponed as part of the optimization, users should configure a maximum length of postponement for the software to consider.

Priority
The optimization can consider priority of different materials and prioritize certain products to be delivered as soon as possible.

Transportation zones
Transportation zones can also be configured so orders coming from suppliers or going to plants in the same zone can be grouped and shipped together.

How does transportation planning software ensure optimal and actionable results?

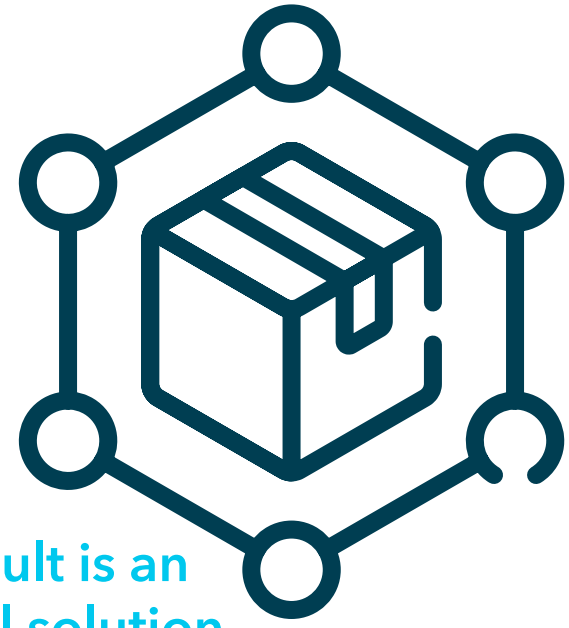
Transportation planning software must balance and combine different optimization goals. On the one hand, transportation of materials must be optimized for cost while considering load building constraints and rules. On the other hand, opposing objectives such as maintaining optimal inventory levels must be taken into account.

The software depends on different algorithms to balance these goals. Some are designed for one of the objectives listed above. These are then combined with additional algorithms that consider the different objectives simultaneously. The result is an optimal solution considering all constraints.

State-of-the-art algorithms give users optimal results by considering constraints like multi-dimensional transportation capacities or storage capacities. However, it is much more difficult to implement practical restrictions such as stacking, consideration of priorities or inventory. Here, specially designed algorithms that use mathematical optimization are key.

Once the materials have been assigned to shipments, the load can be further optimized with special algorithms.

Simpler restrictions – for instance, if the business does not want to increase stock additionally at the end of the month, or the parameter of maximum expedite – can be taken into account when building the optimization model. Special algorithms are not necessary for this process.



The result is an optimal solution considering all constraints.

How does transportation planning software work for different use cases and what benefits does it bring?

Early transportation optimization brings benefits for various use cases, not just full truckload or road transportation. Considering that the main value added is an overall increase in planning efficiency and quality with a direct impact on transportation savings, the variety of use cases is wide.

Below, some of the main use cases and benefits are explained.

FTL

This is a classic use case for transportation optimization to improve utilization of full truckload (FTL) transportation. By optimizing material call-offs for FTL lanes, shipment size and call-off volume can be planned to create fully utilized FTL shipments. As a result, businesses achieve greater utilization of trucks for each lane.

The savings potential in this use case depends on a business's as-is utilization rate and the potential for consolidating call-off volumes in the same shipment by preponing demands. With increased utilization, the number of shipments needed for the call-off volume can be reduced, generating transportation costs savings.

LTL

Optimizing call-offs for less-than-truckload (LTL) shipments shipments allows businesses to consolidate shipments and reduce transportation frequency. Depending on LTL tariff structures, this change can lead to significant transportation cost savings. Additionally, consolidated shipments mean fewer handling costs in the goods receiving processes and potentially fewer stops at destination sites.

Container shipping

FTL and LTL uses cases can also be extended to include container shipping. Full container load (FCL) and less-than container load (LCL) shipments are also valid scenarios for applying transportation optimization to call-offs. Due to longer lead times in container supply chains, a longer planning horizon is necessary in this use case to have a good basis for optimization.

Outbound transportation

The inbound supply chain is the classic use case for transportation optimization of call-offs. But the outbound supply chain can also benefit, especially between production and distribution sites or between warehouse and distribution sites. Businesses can perform transportation optimization for demands or transportation orders as long as order or demand dates can be shifted to enable shipment consolidation.

Extra tips and best practices

Implementing transportation optimization brings significant benefits and is well worth the effort. To help businesses make the process as smooth as possible, we have collected some extra tips and best practices.

Define the scope of optimization

based on the current utilization rate, manual optimization effort and potential for consolidation of volumes.

Start small

and focus first on 20% of lanes or those that are ready for optimization. Apply the same guideline for transportation modes. Start with one mode, like FTL, and continuously extend the scope to achieve the full optimization potential.

Involve stakeholders

from the beginning. One of the main goals of this process is to eliminate silos and inefficient back-and-forth communication. For this reason, it is critical that all stakeholders from both material and transportation planning are on board and aware of the changes.

Track and share results

and efficiency improvements. Sharing positive results with the relevant stakeholders illustrates the value of their effort and helps with change management. Demonstrating tangible benefits also helps ensure continued support from leadership.

Data preparation and quality

are crucial in transportation optimization because they enable accurate and efficient decision-making. Inaccurate or incomplete data can lead to incorrect assessments of transportation needs, resulting in an inefficient use of resources and increased costs.

In our experience, the most relevant data include:

Shipment data
Information about the size, weight and destination of shipments

Packaging information
Information about packaging dimensions, stacking factors and mixed pallet constraints

Delivery data
Data about delivery times, location of shipments and service level

Means of transportation data
Information about the capacity, freight agreement and mode of transportation

Cost data
Data on transportation costs, including carrier fees, fuel costs and overhead costs

To ensure the quality of these data, it is important to establish data collection processes that are consistent and accurate. For instance, validating data against known benchmarks helps identify errors and inconsistencies.

By prioritizing data quality and preparation, transportation optimization can be achieved with greater accuracy and efficiency, resulting in cost savings and improved satisfaction with the optimization results.

Conclusion

Integrating transportation optimization and load building in the material planning phase brings businesses numerous benefits that can greatly improve overall operational efficiency and achieve significant cost savings. By consolidating call-offs based on transportation constraints, businesses can minimize transportation costs, optimize load capacities and reduce empty miles traveled. This streamlined approach ultimately leads to a more cost-effective supply chain and higher profitability.

Businesses can boost planning efficiency and ensure smoother execution of plans by eliminating the silos that typically exist between transportation and material planning departments. With better alignment between transportation and material planning, there is less need for back-and-forth communication and last-minute changes. This eliminates costly exceptions that often arise from unreliable planning. In this way, enhanced coordination saves time and eliminates redundancies, ensuring a more efficient use of resources. As a result, businesses can enhance their responsiveness, meet customer demands more effectively and improve overall customer satisfaction.

Integrating transportation optimization and load building in the material planning phase brings businesses immense benefits: significant cost savings, improved planning efficiency and smooth operations. With this integrated approach, organizations can enhance their competitive edge in the market, strengthen their supply chain and achieve long-term success.

Did you know?

4flow offers plug-in software solutions that help users automatically integrate transportation optimization and load building in the material planning phase. The optimization algorithms used in 4flow's software solutions are developed in-house and are the result of over 20 years of supply chain optimization expertise. Our software is developed continuously to enable faster run times, sustainable cost reduction and reliable improvement of transportation utilization.

If you're interested in learning more about transportation planning software from 4flow, visit our website.

Interested or have questions?
Contact us!

Get in touch to have your questions answered or to schedule a live demo of our software solutions.

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