Transportation Optimization: Is This the Next Step?

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Cost reduction through effective transportation management remains a high priority for most organizations. The challenges include decisions about where the greatest opportunity exists, what systems or technology investments to make, and what operational changes need to take place in order to realize the greatest benefit. The variety of solutions and approaches that are available to address transportation management make these decisions even more difficult.

When it comes to transportation operations, many companies still operate either partially or entirely in a manual, paper-based mode. Depending on the complexity and volume, there are often significant opportunities to improve shipping performance. By simply automating the routing, rating, consolidating, manifesting, auditing and claims process, companies can realize shipments that are more accurate, compliant and cost-effective every time. This provides an opportunity to impact both top and bottom lines of an organization.

However, many companies feel the need not just to automate, but also to optimize because of the implied promise to reduce costs. Although there is great potential for savings when it comes to the use of transportation optimization technology, many times shippers are not ready to deploy and support this technology and/or their transportation network does not warrant this type of technology.

Optimization technology has been used to model transportation networks in an effort to support infrastructure decisions, resource planning, and contract negotiation for a number of years. Optimization technology has also been used at an execution level to solve very high volume consolidation problems and complex network problems with multiple origins, destinations and hubs. These environments are typical of 3PLs and very large manufacturers.

Risk is part of any significant opportunity and the adoption of transportation optimization is no exception. Risks manifest themselves through failed implementations, cost overruns, ROI shortfalls and significant, unpredictable supply chain disruption. The purpose of this paper is to help readers gain an understanding of what is required to rationalize optimization technology and to identify the prerequisites for the adoption of optimization to mitigate risk and set appropriate expectations.

Transportation Automation and Optimization

Automation and optimization represent two very different parts of a transportation management system. Quality automation applications address all the steps and processes necessary to execute shipment transactions, whereas optimization targets only one task within the execution process—load building.

Automation

Solutions that automate transportation execution capture the essential operating characteristics of the transportation network to improve the planning and execution of shipments. These solutions can be deployed across the organization while being managed and defined centrally to leverage corporate operational requirements.

Automation reduces costs through the elimination of errors, enforcement of corporate strategy and policy, minimization of labor requirements and reduction in the number of exceptions. This is accomplished by defining all the parameters and rules that represent the predictable aspects of a transportation network such as carrier rates and lanes, customer routing guides, accounting processes and rating and routing decision criteria. These rules are applied to every shipment to ensure that accurate and appropriate processing takes place without human intervention. Processing addresses every step from order entry through load planning, shipment confirmation and financial reconciliation.

Automation also benefits load planning efforts through improved information visibility, filtering tools, load templates and other functionality that greatly simplify the decision making and load execution process.
Optimization
Optimization solutions focus on cost reduction through improved consolidation opportunities that occur in high volume LTL environments and highly complex transportation networks. The strategy involves the ability to consider a significantly greater number of combinations and permutations of load configurations than humanly possible in order to generate more cost-effective transportation planning.

Optimization uses complex algorithms and mathematical programming to process large batches of shipments and create multiple truckloads with total aggregate costs that represent best cost scenarios. This is an iterative process that creates hundreds or thousands of possible loading scenarios and searches for incremental improvements over previous best cost scenarios.

These engines depend on the same information required by solutions that automate transportation execution, including entity definitions, carrier contracts, lanes and rates, orders, customer preferences and other operational constraints. Therefore, optimization is an extension of an automation solution.

The Prerequisites of Transportation Optimization
A discussion of the technology behind transportation optimization is beyond the scope of this paper although irista recommends that companies that are considering the technology should research this area. In this paper, we discuss the practical steps and considerations that need to be made in order to understand whether optimization is applicable to a particular transportation network and, equally important, whether it is feasible to implement optimization into that network.

The following are some common questions about optimization technology. By presenting answers to these questions, we hope readers will get a better understanding of the capabilities and opportunities that exist for optimization. This knowledge can then be used to evaluate solutions based on their benefits and risks in the context of the intended network.

What is the difference between strategic, tactical and execution optimization?
It is important to understand that optimization technology is configured to suit the problem it is trying to solve. The methods, mathematics and sequencing of strategies are designed to deal with the volumes of data and constraints that are most relevant to finding a solution. Strategic, tactical and execution planning require very different application of optimization technology. The greatest difference between strategic, tactical and execution level optimization is in the granularity of constraints used to define the boundaries of the solution. For example, at a tactical level, it is common practice to use forecast shipment data, simplified rating calculations and generic product information. This is acceptable at a tactical level because this information is adequate to provide answers to questions such as "what resources will I need if...?" or "what would happen if...?" in a reasonable length of time. In contrast, if that same level of detail were to be used at the execution level, the resulting plan would build loads based on financially incorrect data and ignore issues such as consignee time windows, product exclusion rules and customer routing compliance with the result that any loads produced would not be executable.

It is critical to select technology that will produce plans that conform to the constraints that are used to make everyday decisions. The wrong engine, specifically an engine that cannot consider the full extent of execution-level constraints, will generate additional administrative effort and negate much of the incremental benefit achieved through optimization. Therefore, an evaluation of an optimization should include a determination of the extent that operational constraints can be incorporated. Averages, assumptions and workarounds should raise a red flag.

Is optimization more cost effective than automation?
In most moderate volume environments, the use of tools that automate planning and execution can provide a benefit that is comparable to optimization. A robust transportation execution solution that includes load building functionality will lay the groundwork and provide the functionality necessary to empower planners with the information they need to identify opportunities and reduce costs. With a lower cost of ownership, these results can be attained more quickly and with a higher degree of certainty.

While planners cannot reasonably consider the thousands of possible consolidation combinations, significant savings can be achieved using basic rules of thumb to create loads. In fact, the first few strategies that an optimization engine uses are typically the same strategies that planners apply intuitively. In many cases, inefficient planning is not the result of a lack of optimization, but a lack of
visibility and tools to help in planning shipments. An optimization engine requires many of these same
tools.

**Does optimization eliminate the need for load planners?**
Optimization is often presented as a decision-making tool that can take the place of traditional load
planners and do a better job of consolidation. This is simply a dangerous assumption for many
reasons-most significant is the dynamic nature of transportation execution. There is a potential for
change in the network or in the orders themselves that can impact the execution of shipments. Loads are
optimized based on information at a specific time. There is a window of opportunity between
post-planning and execution that is wide enough for unforeseen changes to occur. These changes may
require the suspension, replanning or retendering of loads very near the time of execution. Additionally,
some factors, such as construction and carrier volume commitments may be difficult to configure in an
engine and, therefore, modifications may need to be made after the plan has been produced. It is
infeasible to expect the engine to replan on such short notice because of the impact on every other
shipment being processed. Therefore, there is still a requirement for a planner to review and edit all
plans that come from an engine. It is likely that most will be executable, but there will be a few loads
that require additional attention as a result of order changes or other environmental factors.
Optimization engines cannot make decisions. They can only recommend solutions based on information
available at a point in time. Reliance on optimization to make decisions will increase the number of
shipment exceptions, increase expediting, increase labor costs and allow the processing of infeasible loads.

**What existing costs apply to optimization benefits?**
Total transportation expense is sometimes used as a basis for calculating financial benefit. This is a
highly inflated number that is not appropriate for making such a calculation. Total transportation
expense is made up of inbound and outbound transportation, parcel, LTL, truckload and other modes
used in shipment execution. Not every scenario is relevant for the calculation of optimization ROL For
example, parcel carriers are used to ship small packages quickly despite the high cost. They should
never be considered for optimization. Also, full truckload orders provide no room for improvement as
they are already full.

Only LTL shipments and truckloads that are made up of more than one origin-destination pair should be
applied to an optimization ROL Otherwise, if extraneous data is used to calculate an optimization ROI,
the potential benefit will be inflated and result in the potential for artificial cost justification.

**What are, network constraints and why are they important?**
All shipping networks have constraints. Some customers require a specific carrier or service level.
Others have tight time windows or require special equipment.
Products have exclusion rules and may require special handling. These constraints represent the actual
execution parameters within which daily activities must take place. Constraints are a natural part of
every network but they have a dramatic impact on the ability of an optimization engine to perform its
job. Each constraint forces the optimization engine to consider something that is less than feasible and
work other deliveries around it. If the transportation network is typical and contains many operational
and customer level constraints, there will be a reduction in the percentage opportunity calculation. This
can be as much as 50%.

**How do shipment volume and shipment density affect optimization?**
The benefit that optimization can achieve depends heavily on having sufficient volume to maximize the
number of alternative load plans to be considered. For example, if there are 2500 possible combinations
of moving 50 shipments, although most are either infeasible or expensive, there is a subset that can
deliver value. If there are 500 shipments, there are 250,000 combinations.

Density is also important as 500 shipments that are equally dispersed across the USA provide a much
smaller opportunity for consolidation than 500 shipments that are all going to Georgia. Unless there is a
high volume of qualified, unconstrained shipments with a sufficient density, optimization can provide
little financial benefit.

**How well do you understand your entire network?**
As part of any optimization implementation, it is assumed that there is an intimate understanding of the
transportation network, all of its components, and the multitude of interdependent relationships that
exist at any point in time. The reason is that an optimization engine derives its answers based on a
model that reflects the business environment within which it operates. But, unless transportation management has been addressed as a core corporate competency for at least two years, it is likely that knowledge of the network, instead of being centralized, is shared between numerous groups. Costs are maintained in accounting, carrier contracts are at the local DCs, customers are managed by customer service. The result is that time and effort must be spent to fully understand the whole operation. If the environment is poorly understood or ill defined, the output from the engine is not only inefficient, it is likely to be infeasible.

**In the execution process, how much time is available for optimization and replanning?**

It is assumed that there is a reasonable amount of time available between order cutoff and shipment execution to run the engine, create the plan, and execute the transaction in a way that generates the desired benefit.

Execution optimization presents an interesting problem for optimization engines. This is due to the fact that all engines run in a batch mode. This means that all shipments being considered by the engine are suspended for a period of time. This issue is amplified by the size and complexity of the problem being solved because of the increased time required to solve large, complex problems. In many cases, the time required to solve problems is addressed by changing the parameters and sequence of heuristics to reduce the number of iterations so that fewer plans are considered and less time is required. This strikes right at the heart of any optimization strategy. Therefore, the environment must either sacrifice potential savings for time or provide enough time between the start of an optimization run and the lead time required to execute the plan.

**Does sufficient internal expertise exist to manage the optimization engine?**

Management of an optimization engine requires specialized training and experience. Optimization engines are highly complex mathematical models and cannot be effectively managed by just any smart person. Typically, personnel with operations research training have the required knowledge.

There are two challenges. The first is the cost of hiring and retaining a qualified technician. The second is the risk of losing that person and the cost associated in time and dollars that result from the disruption involved in rehiring and retraining. A potential solution is to retain a consulting service to operate the engine on your behalf. However, there may be a time lag between need and action as well as less than intimate knowledge of your network. The upside to a third party is in their breadth of experience and commitment to continuously upgrading skills. Cost of ownership must take into account the ongoing expense of skilled resources or the services of a third party. Additionally, a factor must be added to address the risk of turnover for this specialized role in the organization.

**A Summary of Red Flags**

Based on the previous information, there are a few red flags that emerge. This list should provide a reason to pause and consider whether optimization is truly a rational strategy.

- The value of transportation expense applicable to optimization is less than $5,000,000.00.
- A significant percentage of shipping is constrained by customer, product or operational rules.
- Consignee locations are geographically fragmented with few areas of density.
- Network understanding (structure, rules, data) exists in silos.
- The network has evolved into its current state rather than being operationally directed.
- The time window between last possible change to an order and execution is less than 12 hours.
- Execution infrastructure is not aligned with optimization capabilities or vice versa.
- Internal expertise does not include qualified personnel to operate or maintain an engine.
- Manual planning tools have not been applied for at least 12 months.
- Centralized, comprehensive transportation management applications have not been in place for at least 12 months.
- Data is not complete or easily accessible.

**A Practical Approach to Adopting Optimization**

Regardless of the assumptions presented in this paper, there are many legitimate and potentially valuable opportunities for optimization. The trouble is that it is often impossible to truly measure how
effective optimization will be without first gathering data for a period of time so that it is rich enough to establish the current baseline from which to measure improvements. Therefore, application of technology to transportation management should follow three distinct steps.

First, systems must be put in place that can automate the majority of the execution activities in the transportation network. In order for this to be effective, relationships must be defined between the company, carrier, suppliers and consignees that describe how transportation should take place. Routing guides are established, rating engines are configured and processes are adapted to take advantage of improved visibility. By doing this, an understanding of the physical infrastructure begins to emerge and be electronically defined, automation is enabled, exceptions are identified, and data is gathered for each and every transaction.

Second, after a sufficient base of experience and data has been established (at least one year), modeling tools can be applied to determine how strategic and infrastructure changes might impact costs. For example, customer constraints can be evaluated to determine the cost of loosening or tightening the constraints. This allows for basic rules to be applied that may impact overall costs. These rules can be defined within the execution system to ensure that the new strategy is followed globally. Modeling tools can also be employed to begin evaluating more advanced consolidation opportunities. Given the understanding of constraints and real historical data, an accurate determination can be made as to whether optimization can provide ongoing incremental improvements to planning and whether these improvements justify the additional overhead.

Finally, if the case is made that optimization is beneficial, the engine can be implemented to leverage the existing execution infrastructure in order to ensure that it produces feasible and executable plans.

This is a long process. There is no shortcut to building the most effective transportation execution solution. However, with a practical approach to addressing transportation execution, technology investments can be made considering the incremental improvements provided by each step. This dramatically reduces the risk of failed implementations, cost overruns and, most seriously, disruptions in the supply chain.

**Conclusion**

The assumptions described in this paper should provide a reasonable basis for consideration as to how, where and when to apply optimization technology. In some cases, automation may be the answer. In other cases, a targeted approach to optimization with automation supporting the wider network could be a solution. In the end, all technology investments must pay for themselves in a reasonable period of time. Eliminating assumptions and understanding how technology works, where it is most effectively applied, and how actual financial and operational benefit is achieved streamlines decision making and reduces the risk commonly associated with advanced technology systems.

**About Irista**

Irista, Inc., an HK Systems company, has a proud history of delivering unique logistics solutions that enable the efficient and accurate flow of raw materials and finished goods through the production, distribution and delivery process for manufacturers and their 3PL partners. Working in concert, Irista's warehouse and transportation management applications optimally direct logistics activities based upon the real-time conditions, constraints and priorities of an enterprise's logistics assets. By leveraging Irista's extensive industry experience, proven methodologies and advanced logistics technologies, organizations continually realize an increase in asset utilization, accuracy, quality and compliance, while lowering overall production and distribution costs.

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