

## LOGISTICS NETWORK MODELING: TOOL FOR ADAPTING TO CHANGE

---

*Capacity constraints and the growth in customer service channels compel logistics networks to break new ground and make adjustments. In this point of view, Infosys experts discuss logistics network modeling as a tool for supply chain managers to restructure logistic networks and adapt plans via informed strategic and tactical decisions.*

---

## The need for continuous optimization

There is no abatement in supply chain and logistics complexity caused by the need to improve service levels while lowering the costs of inventory and transportation. In addition, the number of channels to service customers and capacity constraints keep increasing.

Logistics networks need to address several challenges:

- Source from the supplier / country offering the lowest carrying and transportation costs
- Fulfill from the right distribution nodes
- Finalize the number and location of new distribution centers (DCs) to be opened
- Optimize DC capacity based on a trade-off with costs
- Formulate the right mix of carrier and route for each type of product, considering the size, volume, and demand during normal and peak periods

Continuous optimization on a case-to-case basis using conventional thumb rules is impractical. It leads to underperforming logistics networks. Persistent capacity constraints make it difficult for logistics and transportation network managers, freight procurement teams, and finance managers to make timely decisions to meet evolving business requirements.

Logistics network modeling (LNM) offers a solution. It transforms logistics network designing by enabling simulation of various scenarios for comparing the impact of decisions on metrics and outcomes across various dimensions, including cost, service levels, capacity, and freight and fleet mix.

**LNM-based decisions ensure that supply chain operations adapt to changes and disruptions:**

*Firstly*, it helps supply chain managers to simulate plans and undertake an intuitive what-if analysis of strategic decisions across the network, lines of business, customers, markets, and DCs.

*Secondly*, logistics network modeling supports outcome-based analysis. It provides the ability to simulate and compare scenarios across tactical decision points such as carrier mix, introduction of new distribution or fulfillment centers, change of suppliers, and sourcing from a specific fulfillment center.

*Moreover*, spreadsheets and hand-off between analytics and operational teams can be eliminated since real-time operational production data is used to compare various scenarios and simulate operational plans on a daily or weekly basis.

*Also*, the metrics, constraints and time period for analysis can be determined by the user. Analytical results displayed on intuitive dashboards can be easily consumed by decision makers.

*Furthermore*, the outcomes of proposed changes can be known in advance. For instance, how a change in route, DC, transportation capacity, carrier mix, or freight rate affects lead times and / or cost.



## Use cases and opportunities

Logistics network modeling involves structured planning via strategic and tactical evaluation of the logistics network. Various scenarios can be simulated by ingesting operational data along with business rules, constraints and customer metrics to visualize and evaluate the impact on operations and business outcomes.

Let us evaluate some use cases and explore business opportunities:

#	Use case	Scenarios
1	Determine the optimal order frequency or pattern	<p>Alter the ordering pattern and frequency, and simulate results to evaluate the impact on customer service levels / cost to serve.</p> <p>Example: Evaluate the impact of a change from fixed frequency to MOQ-based ordering, or from daily order consolidation to once in two days</p>
2	Plan shipment and execution horizons	<p>Simulate scenarios of order cutoff time for shipment plans by considering warehouse capacity.</p> <p>Example: Simulate, evaluate and execute approaches for operating two shifts vs three shifts.</p> <p>Evaluate optimal shipment schedules for ocean freight lanes with long transit times.</p>
3	Re-align warehouse / DC footprint	<p>Determine the number of outbound / inbound warehouses or DCs required for the anticipated increase in customer base or volume of orders, considering near shoring or offshoring logistics capacity and changes in the tax regime.</p> <p>Finalize the optimal outbound or return DCs by simulating the impact of servicing a given customer base or region from DC A vs DC B, considering the cost to serve and lead time.</p>
4	Optimize load building	<ul style="list-style-type: none"> <li>• Simulate cost savings between LTL and FTL loads or improvement in fill rates</li> <li>• Compare results between various transport handling units such as carton loading, pallet loading, double stacking of pallets, and rainbow pallets</li> <li>• Simulate load building for trucks with side doors vs back doors</li> </ul>
5	Plan cost-effective transportation routes	<ul style="list-style-type: none"> <li>• Find the optimal balance between the fill rate and service time by simulating the number of drop points in last mile delivery or milk run operations</li> </ul>
6	Determine the best cross dock location or distribution node	<ul style="list-style-type: none"> <li>• Simulate and conduct a comparative analysis of various performance parameters such as capacity, inventory availability, operational costs, and lead time</li> </ul>
7	Determine the best carrier mix or selection of carriers	<ul style="list-style-type: none"> <li>• Select the right carriers and determine the best carrier mix</li> <li>• Simulate and compare percentage of pre-booked capacity or dedicated capacity vs dynamic demand capacity</li> <li>• Simulate and compare lead time, On Time In Full (OTIF) delivery, and cost to serve by creating allocation scenarios and scorecards for premium and economy carriers</li> </ul>
8	Optimize freight contracts and negotiate rates	<ul style="list-style-type: none"> <li>• Simulate the change in freight rates and freight budgets due to fluctuations in fuel cost</li> <li>• Determine the right LSPs by comparing various factors such as freight cost, service lead time, geographical reach, and performance</li> <li>• Determine the right contract model – pay per use or fixed cost - by simulating and negotiating rate structures such as per pallet or per drop cost based on insights derived from order and routing patterns</li> </ul>

## How does LNM work?

Let us consider a branded apparel manufacturer with multiple sales channels – own and franchise retail stores, e-Commerce platforms, digital marketplaces, distributors, etc. The logistics network for this company would typically include manufacturing plants, supplier ports, warehouses and / or DCs – own and 3PL, retail stores, and customers.

Due to the growth in e-Commerce, proliferation of SKUs, and customer demand for faster deliveries, the supply chain managers should make two strategic decisions:

- *What is the size and number of additional DCs required?*
- *Which DC should service a market / type of order?*

The supply chain management team can set up the LNM model by following these steps:

1. Create a new project for the strategic decision
2. Define baseline data and data rules for -
  - a. *Product listing*
  - b. *Sales forecast of product SKUs*
  - c. *Location of all nodes in the network*
  - d. *Transport carriers, capacity, mileage, and rates*
  - e. *Costs – DC storage and handling costs, inventory costs, transportation costs, etc.*
  - f. *Shipment / container size*
  - g. *Order patterns*
3. Define parameter constraints or decision variables
  - a. *Demand*
  - b. *Warehouse costs*
  - c. *Warehouse capacity*
  - d. *Carrier capacity*
4. Specify parameter settings or apply the default settings offered by a tool. Parameter overrides can be specified to override baseline data.
5. Define KPIs that need to be simulated
  - a. *Service levels*
  - b. *Cost to serve*
6. Define scenarios for the project. Scenarios involve change in data rules and decision variables that influence KPIs.
7. Use a simulation model or an optimization model. A simulation model only displays the outcome based on the change in parameters in a particular scenario. On the other hand, an optimization model determines the best configuration of parameters to maximize the outcomes for a given set of constraints.
8. Run the scenarios, and view the outcomes on a dashboard



## A pharmaceutical company optimizes truck fill rate and capacity using LNM

The logistics managers of a large pharmaceutical company used Microsoft Excel for planning dispatch of trucks to distributor outlets. They adopted the conventional practice of consolidating all orders for delivery within a city for load planning and truck capacity utilization. Optimal loads for each lane were calculated in Microsoft Excel by using SKU weight and volume data from a master table. The increasing growth in order volume and number of SKUs made this manual optimization method impractical. It also led to transfer of shipping orders to LSPs as LTL, and LSPs charged cubic meter (CBM) rate per lane load volume. Low fill rates and underutilization of capacity increased average cost per case.

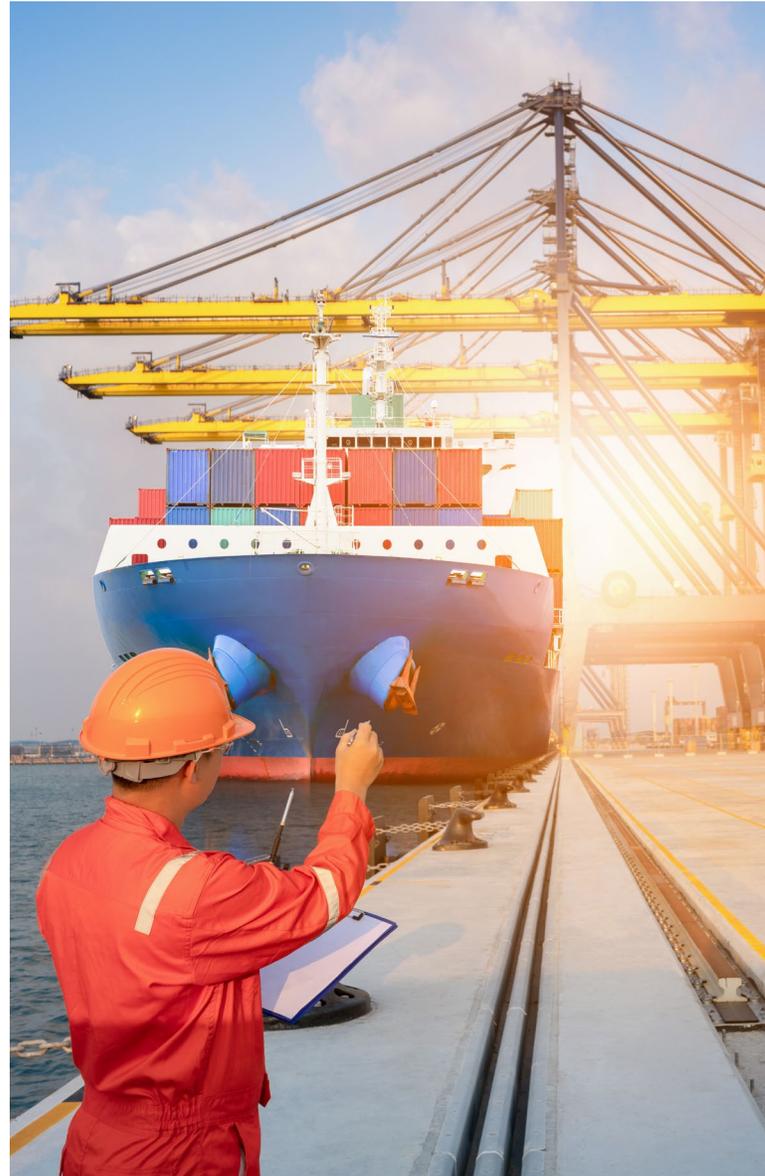
The pharmaceutical enterprise implemented an ERP TMS solution to improve fill rates. Master data of materials, customers, truck types, and LSP contracts was set up. Various constraints, such as customer operating hours, preferred receiving times, average speed of truck in an area, and customers willing for mixed loads, were configured in the system. In addition, production data and customer order data for the last six months were loaded.

Continuous simulations were performed using master data and production data loaded on to the tool. Simulations were performed for three scenarios to analyze the incremental impact on total count of shipments, fill rate of shipments, total cost of shipments, and cost per case per SKU.

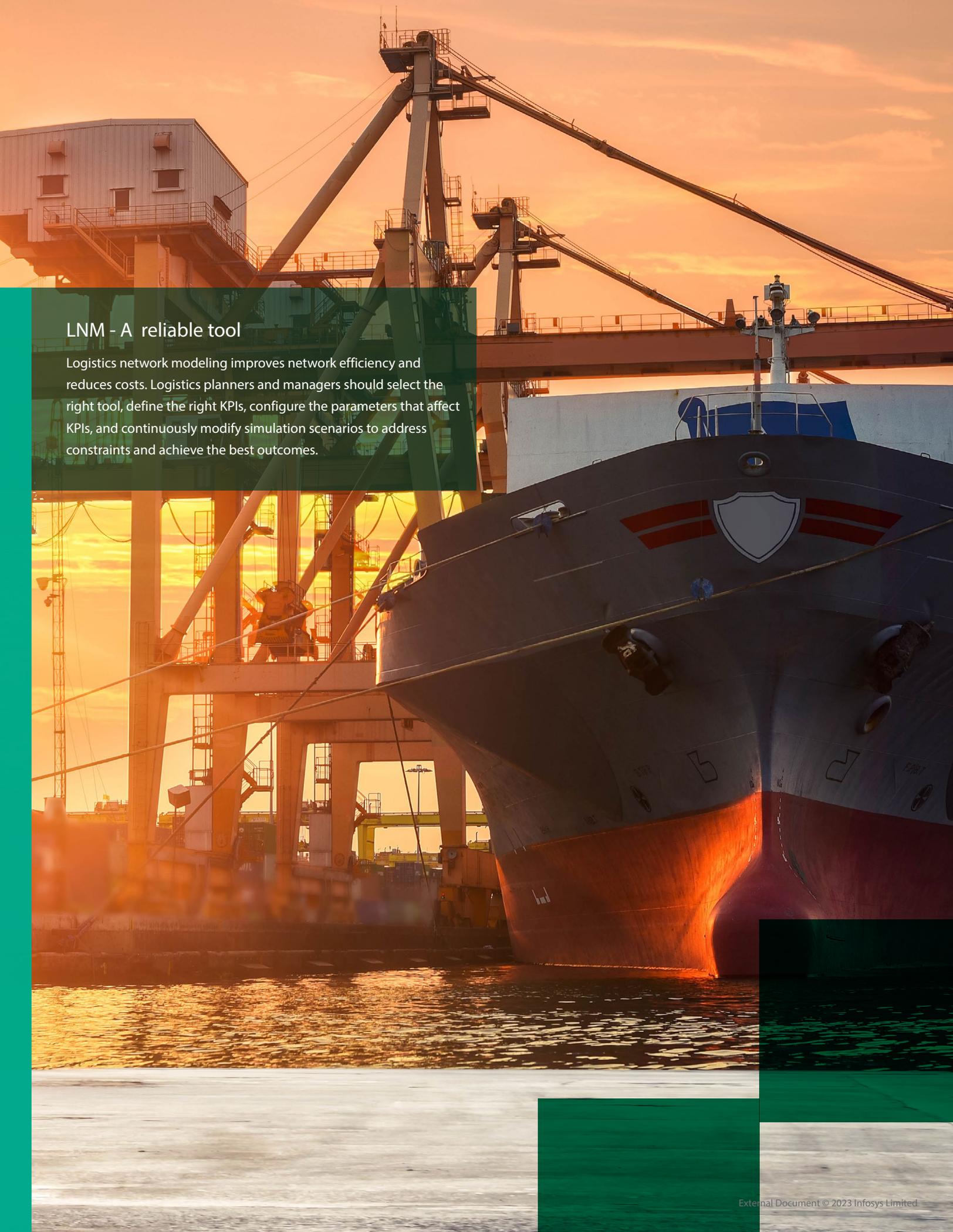
**Scenario 1:** Adopt the TMS tool to optimize loads, capacity, and routes. It improved fill rate from 68% to 74%, and reduced the number of trucks required per month from 476 to 433.

**Scenario 2:** Eliminate the conventional practice of allowing a maximum of two drop points by letting the system calculate the drop points for a 10-hour work shift. The fill rate further improved to 80%, and the number of trucks required per month reduced to 419 for three drop points.

**Scenario 3:** Replace the ineffective practice of restricting delivery to city limits and applying either CBM or per truck rate in freight contracts. This scenario simulated a shift from city-based to distance-based routing, by using geolocational tags for customer and DC data. An iterative approach was used, beginning with a 15-km delivery radius. Routing planned within a 25 km radius increased the fill rate to 87%, and reduced the number of trucks required per month to 399 for four drop points.







## LNM - A reliable tool

Logistics network modeling improves network efficiency and reduces costs. Logistics planners and managers should select the right tool, define the right KPIs, configure the parameters that affect KPIs, and continuously modify simulation scenarios to address constraints and achieve the best outcomes.

## About the authors



**Krishnakant Kasturi**, *Senior Principal, Business Consulting*

Krishnakant has 23+ years of industry and management consulting experience. He manages cross-functional strategic programs spanning business and IT modernization, analytics, CRM, and supply chain management.

He can be reached at [Krishnakant\\_K@infosys.com](mailto:Krishnakant_K@infosys.com)



**Chintan Dushyant Mehta**, *Senior Consultant, Business Consulting*

Chintan specializes in the implementation of end-to-end TMS solutions with modules for analytics, planning and execution. He has rich experience in first mile, last mile, and cold chain logistics operations.

He can be reached at [chintandushyant.m@infosys.com](mailto:chintandushyant.m@infosys.com)

For more information, contact [askus@infosys.com](mailto:askus@infosys.com)



© 2023 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/ or any named intellectual property rights holders under this document.