

Logistics Operations Optimization for 3PL Providers

Third Party Logistics (3PL) providers are competing worldwide through Logistics Optimization to reduce costs while achieving high delivery standards.

Logistics optimization is currently the biggest opportunity for most companies in order to attain significant reduction in operational costs. It can save 3PL providers up to 10 – 40% on operational costs by improving decisions such as the optimal selection of inventory placement and transportation modes.

Logistics Optimization

The third-party logistics provider (3PL) performs logistics services on behalf of another company. There are two primary kinds of 3PL Providers. Type 1 assumes infinite production on supply depot and their only concern is to meet the demand at the delivery nodes. Type 2 3PL providers perform the functions of meeting the demands and also taking into consideration the safety stock and the economic order quantity at the demand node. In order to achieve this, these companies need to maintain certain inventory at their warehouse in order to perform ontime delivery and achieve a certain service level.

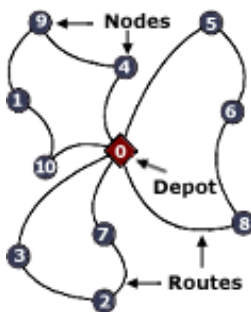


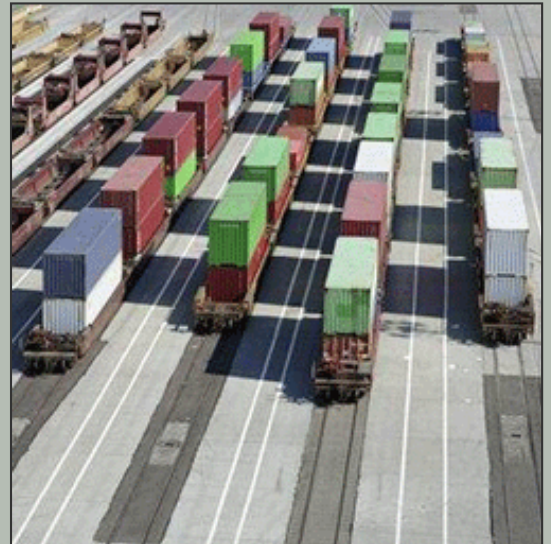
Figure 1: A Common Network

Logistics optimization problem for the Type 1 3PL can be solved with the Vehicle Routing Problem in order to minimize transportation costs. For the Type 2 3PL Company, logistics optimization is achieved by vehicle routing problem and additionally minimizing the inventory carrying costs at their warehouse.

A logistics optimization problem starts with defining the network. Figure 1 illustrates a common network with one supply depot and various demand nodes. The Vehicle Routing Problem determines the routes for the network.

Vehicle Routing Problem for all 3PL providers

The Vehicle Routing Problem determines the set of routes with overall minimum route cost which services all the demands for a given a fleet of vehicles, a service depot, and several demand nodes. Figure 2 shows different types of vehicle routings and also lists the solutions to find the optimized routes.



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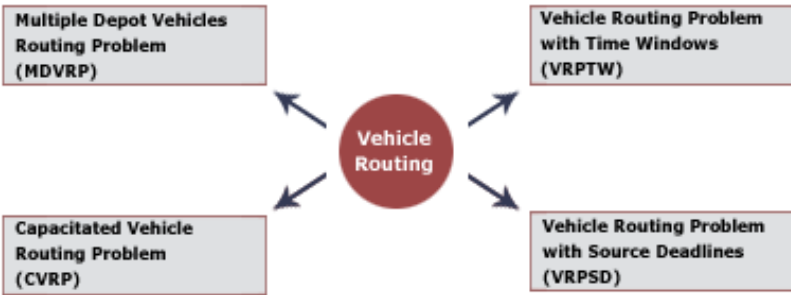


Figure 2: The Vehicle Routing Problem

Inventory Optimization for Type 2 3PL Providers

For the second type of 3PL, the additional objective is to meet the desired service level and supplying the Economic Order Quantity (EOQ) at the demand nodes. This is done cost effectively by maintaining inventories at the 3PL provider warehouse. This can be achieved by the inventory optimization model with the following objective function:

- i. Minimize inventory holding cost, shortage and backlogs

The model minimizes the inventory holding costs ensuring the best feasible solution considering all the constraints. The optimization model considers the following variable and constraints:

- Demands and EOQ calculations at the delivery nodes
- Products and/or product groups
- Penalties on safety stock (Backlog penalties, Shortage penalties)
- Warehouse Constraints (Warehouse capacity)
- Inventory Constraints (Inventory holding capacity by product and/or product group)
- Inventory holding costs

The output of the model provides the optimum inventory levels by product at the warehouse in order to meet the demands at a certain service level and also minimize the inventory holding cost.

Other Optimization Models

Additional function of consolidation of inventories can be added in the above described model, based on the requirement. Here the objective is to convert all Less than Truck Loads (LTL) to Full Truck Loads (FTL). Also, an optimum daily dispatch plan can be created by for a given network and for a range of product. The objective function is to minimize transportation costs, inventory holding costs and penalty costs in order to minimize consumption of safety stock and avoid backlogs. The function can be modeled mathematically as below:

$$\text{Minimize } \sum (\text{Transportation Costs}) + \sum (\text{Inventory Holding Costs}) + \sum (\text{Penalties})$$

The objective function is subjected to the following parameters:

- Demand shortage
- Actual opening inventory
- Safety stock shortage
- Supply

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- Penalty cost for late shipment, early shipment and safety stock consumption
- Shipment quantity
- Transportation Costs (Fixed and Variable)
- No. of Transports
- Net demand
- In transit supply
- Node capacity violation
- Product quantity
- Inventory carrying cost

Conclusion

Logistics optimization provides strength and value to the 3PL supply chain. Companies are allocating resources and money to make their logistics departments more efficient and economic. Through proper planning and using the right logistics optimization tools, companies can acquire considerable cost reduction across their logistics & distribution operation and can accomplish better delivery standards.

Next Issue: To be decided

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