Total Cost Optimization

Reducing total delivered costs through improved production and distribution planning

Controlling the total delivered costs of products is often key to profitability. While many companies have launched long-term initiatives to reduce these costs—such as strategic sourcing, manufacturing in low-cost countries, and redesigning distribution networks—short-term solutions can be more elusive. To capture more immediate results, we recommend total cost optimization. This approach can improve production and distribution allocations, cutting total delivered costs by 1 to 2 percent on an ongoing basis—and do it quickly.

As companies grow, their production and distribution networks become ever-larger and more complex. Often the same product is produced in multiple locations, with manufacturing costs in each location varying due to different distances, technologies, efficiencies and a host of local factors from power and labor costs to government incentives.

Supply planners have become adept at reducing total delivered costs (which can range from 50 to 80 percent of sales) in the long term, using strategic sourcing, vendor co-location, manufacturing in low-cost countries or zones with special tax-incentives, and rationalizing their manufacturing network, among other things.1

But reducing costs in the short-term is another matter. As the slowing economy forces companies to search for “quick-wins” to cut costs immediately, more companies are turning to total cost optimization (TCO) for production and distribution planning. TCO can help reduce total delivered costs of products quickly and within existing constraints. It allows an analysis of all variables across locations to find the optimal way to allocate products—and achieve the lowest overall cost.

A New Way of Thinking

A total cost optimization strategy aims at minimizing total costs—in materials, conversion, distribution, taxes and incentives—through an optimal production and distribution plan for each planning period. Companies that employ a TCO strategy can reduce their total delivered costs by 1 to 2 percent on an ongoing basis.

How TCO works. Total cost optimization uses linear programming (LP) to analyze production allocation.2

1 Total delivered costs include input costs, conversion costs and distribution costs. Supply planning affects the variable component of total delivered costs, which varies across industries.

2 Linear programming: quantitative analysis technique for optimizing an objective function given a set of constraints.
It considers all practical constraints, such as meeting demand at all locations, or working within the capacity limits of production lines, then uses cost, capacity and demand data to find an allocation that minimizes costs (for more on linear programming, see the sidebar, Getting Analytical). Typically, linear programming can be developed using basic spreadsheet functions such as the Solver add-in for Microsoft Excel.3

The more complex the situation, the bigger the potential savings of the TCO approach. Savings will increase relative to three factors: a large number of multiple-source products, a high degree of production flexibility, and the extent of cost differences across various destinations and locations.

What makes TCO different? Conventional supply planning often relies on experiential “rules of thumb.” For example, allocating demand from each region to the geographically closest source; producing high-volume products at one large production line; and fully utilizing plants located in zones that offer incentives.

The trouble with rules of thumb is that they tend to focus on just one cost at a time and do not account for other variables, often failing to address the sheer size of a production and distribution network and the number of possible allocation combinations. For example, if a company has four products and three plants, there are more than 2,400 ways in which the products could be assigned. With tool-based optimization, it is possible to assess trade-offs among multiple elements and thus find the most savings (see figure 1). TCO also allows companies to periodically reassess the allocation as circumstances change.

**Cases that prove the point.** The beauty of total cost optimization is that it can be easily customized. For example, we helped implement TCO for an Indian subsidiary of a global cement manufacturer that wanted to change its objective from minimizing total costs to maximizing total contributions. In the LP analysis, we included pricing information at various demand locations, while relaxing the constraint of meeting projected demand. This allowed us to select the most profitable markets to serve, given limited supply, and provided insights on the cost-to-serve for various markets, which the company's sales and marketing used to make pricing decisions.

For a fast-moving consumer goods company, we incorporated production labor costs into the TCO analysis. We did so even though labor was considered a “fixed” cost since the company could neither retrench nor redeploy its workers in the short term. Our analysis helped identify a high-cost manufacturing plant that could be downsized fairly quickly.

In another case, we helped a processed food company that makes beverages in powder form and then ships in bulk to packaging units downstream. The final packs are then shipped further to multiple warehouses for eventual sale to customers. By optimizing product-mix allocation

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3 Added complexity may necessitate more advanced tools. The pre-installed Solver can handle linear programming (LP) problems with up to 200 variables; Premium Solver can manage LPs with up to 8,000 variables; and advanced optimization solutions such as Lindo, CPLEX and SAP-APO, I2 can deal with even larger problems.
using TCO across these three layers, we were able to reduce total cost while simultaneously making the planning process simpler.

**There’s More**

Total cost optimization can also help standardize processes and reduce the time and effort it takes to plan production and distribution. TCO supports the following processes:

**Budgeting.** Total cost optimization helps companies to more quickly develop annual projections on production and create dispatch plans.

**Fleet planning and freight negotiation.** The forward dispatch plan helps assess fleet requirements and plan vehicle loads. Data on committed volumes for plant-distribution centers can be used to negotiate freight rates.

**Production scheduling and material planning.** TCO suggests product-mix allocations that can be used for production scheduling and material planning.

**Finished goods inventory planning.** The dispatch plan will help set inventory norms at distribution centers. The analysis can also be used to develop stockpiling plans to meet periodic capacity shortfalls.

**Getting Buy-in**

Successful total cost optimization depends on complete organizational buy-in, including key areas such as planning, procurement, manufacturing and distribution. To obtain buy-in companies can make sure everyone understands the TCO objectives and tools, and create incentives to encourage appropriate behavior.

For example, TCO may require the under-utilization of one facility. If that facility manager’s performance is measured on total conversion cost per unit of production, then lower utilization will have a negative impact on that measure, making buy-in unlikely. To fix this, we define short-term manufacturing targets at this facility around variable rather than total conversion costs. Similarly, procurement

**Getting Analytical**

Linear programming is an analytical technique that can find savings opportunities within a production and distribution network. In the figure below, the sample company needs to determine how much of each of its two products must be produced at two source locations to meet demand from two destinations. Linear programming creates a formula, using as variables the quantities of each product flowing from each plant to each demand center. The objective is to minimize the total costs of material, variable conversion, distribution, taxes and incentives for each source-product-destination combination. We consider variable conversion costs only because fixed costs in the short term would continue to be incurred regardless of the quantity allocated to a facility. The basic constraints are to ensure product demand is met at each location, and to confirm that no plant is allocated volumes beyond its capacity.

Linear programming helps supply planners evaluate the total cost of all possible allocation combinations, so they may choose the best one.

**FIGURE:** Linear programming technique
professionals will need incentives to encourage them to structure flexible vendor contracts that allow fluctuating volumes at different manufacturing locations. For distribution, baseline costs for measuring efficiencies must account for changes in product-plant allocations for each planning period.

The effectiveness of total cost optimization is directly related to the quality and accuracy of input data on costs and capacities. Specifically, TCO requires accurate landed raw material costs and the division of conversion costs into fixed and variable categories at each manufacturing location.

**TCO Is a Journey**

As organizations grow, products, locations and costs proliferate. Total cost optimization is a simple and scalable technique that helps reduce total delivered costs and improve process efficiencies quickly. However, it is not just a one-time exercise, as it can also improve production and distribution processes on an ongoing basis. In today’s volatile business environment, nimble companies with this capability will have the advantage.

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