

# Enterprise Optimization Case Study

## Profit-Chain Consulting

### Our Client

A manufacturer of industrial products for the automotive, primary metals, and other industrial segments with sales nearing \$1 billion. They operate 10 plants on 4 continents serving a global customer base with a wide variety of products consisting of size, grade and finish characteristics tailored for each application or customer.

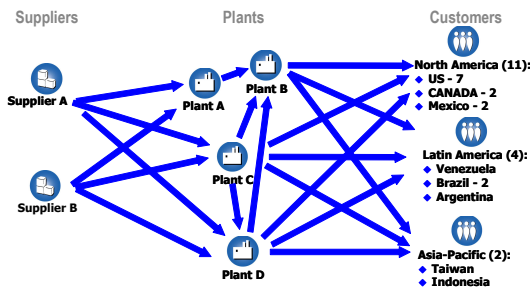
Our client faced increasing competition from strengthening competitors, softening demand, and weakened currencies to a consolidating customer base. Customers were pushing harder on prices, bidding out more contracts and consolidating suppliers. A tough market was getting even tougher.

### Simulating The Process

Creating and analyzing new operating plans was not an easy or straightforward task. In most cases, the forecast could be translated into a number of alternative plans with capacity balanced, but deciding which one was "better" was difficult.

For the plan alternatives, determining profit and service implications was filled with assumptions and rules of thumb. For example, comparing alternative production plans used typical production costs for profit analysis. However, it was well known that costs varied based on what product mix and volumes were being run, requiring modification and estimates of the pluses and minuses to costs.

The problem became clear: plan trade-offs must be made with operating costs that represent the specific planned operating rates. These costs and the associated revenues were needed to form a complete picture of the profitability trade-offs for each plan scenario. The first step was to model production operations in more detail:



This graphical version of the model shows how every feasible production source and destination was modeled using variable costs. With a variable cost model, costs that were truly fixed over the planning horizon stay fixed. This created a model without the built in bias to over produce. "Actual" costs were calculated based on the planned suppliers, production, and the transportation lanes.

The model was built in an optimization application that accepted current planning information and parameters. Customer orders, forecasts and current inventories were key drivers of the operational

plan. Selected cost and operating parameters were updated in each planning cycle, such as supplier costs, yields, changeover times and other significant cost items. With this data, the application used advanced mathematics to create alternative plans for comparison.

### Making Profit Trade-offs

Output of the model included the capacity analysis and a complete financial projection for each alternative. This provided a range of solutions for consideration. An initial optimization run compared several different alternatives:

- Optimization of the prior plan (base case)
- Unconstrained demand chooses customers and products that maximized profitability (same market share)
- Sensitivity analysis showing the variables where small changes make a corresponding large change in profit
- Spikes in demand that may require re-planning

Results from each of the planning runs provided significant lessons learned and guidance on future plans:

Scenario	Key Learnings	Application Concepts
Optimization of Base Case	Shift of production from Plant D to Plant A and Plant B	Opportunities to load Plant D with more product XX
Unconstrained Demand	Which products to make and where, given free choice	Input to Marketing and Sales efforts --- choices may be counter-intuitive to current emphasis
Sensitivity Analysis	Further shifts of production from Plant D to Plant A	More Plant D product XX opportunities. Evaluate capital spending impact and payback.
Spikes in Demand	Production Levels shifted slightly out of Plant A once new demand was introduced	A spike in demand could cause a need to replan to optimize profit - Determining the threshold of change

The most dramatic result was allowing the model to choose products and customers. The results were dramatic: over 20% increase in profit with the same market share! The insight was which products enabled the most efficient production and highest total profitability. This was counter to view of the previously high margin products.

The key challenges were developing a representative model of the enterprise and integrating model inputs/outputs into comprehensive planning processes. There are numerous ways to model an enterprise requiring more art than science to build an effective model without creating unmanageable complexity. A model must be accurate in key areas and have a firm basis in cost trade-offs.

### Results

Business and operations planning transformed from a protracted series of analyses, discussions and debates into a streamlined decision making process:

- Profitability increased by \$5 million/year
- Most profitable customers/products well documented

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