

# Optimization

## What is it?

Optimization is the determination of the ‘best possible’ set of decisions to be taken at any moment in time.

Operational decision-making problems involve making a set of choices that achieve the best possible outcome (often maximizing profit) while respecting a number of business-rules (e.g. customer requirements, demand fulfillment, etc.), known as constraints.

1947 - George Dantzig develops pioneering linear optimization algorithm.

To find the ‘optimal’ course of action amongst all the possible decision combinations requires models with advanced algorithms. Without this state-of-the art mathematics, the sheer number of possibilities would render these types of problems intractable.

## Present Day

For years, many of the world’s largest corporations have been using optimization models running on supercomputers to help optimize their operations and processes. New technology has leveled the playing-field, allowing any-sized organization to use optimization modeling to:

### Optimization:

Your decision-making intelligence engine.

- Increase throughput and eliminate bottlenecks
- Develop intelligent and responsive pricing schemes
- Create ‘lowest-cost’ staff schedules and timetables
- Synchronize production scheduling
- Build risk-balanced asset portfolios
- Improve customer relationship management
- Plan floor space
- Allocate the right mix of product types
- Manage all aspects of the modern supply chain

## Success Stories

Some ground-breaking optimization applications:

- Bombardier FlexJet to reduce crew levels by more than 20%, while maintaining service levels above 90%.
- NBC to improve its advertising sales process with optimization-based systems, increasing revenues by \$200 M between 1996 and 2000.
- Ford Motor Company to reduce annual prototyping costs by over \$250 M and dramatically shorten the planning process.
- Canadian Pacific to optimize the routing of rail cars, reducing transit times and cutting its cost base by \$285 M.
- France Telecom to rapidly react to market changes by updating business rules on the fly, slashing the time required to implement new policies.
- DaimlerChrysler to improve turnover rates by 10-20% and reduce inventory by \$20 M.
- eBay to enhance the user experience of their site.

# Syllogix's Optimization Process

## 1. Consultation

- A co-client exploration of the decision-making problem at hand is performed.
- The relevant optimization methodology is determined (linear/non-linear programming, stochastic dynamic programming, marginal analysis, etc.).
- The data requirements and availability are assessed.

## 2. Modeling

- The decision-variables, objective function, constraints and their inter-relationships are represented by mathematical formulae.
- If appropriate, the math is coded into a software model, using powerful optimization modeling environments. This model is then solved by computers and the optimal solution determined.
- Alternatively, the mathematics may be further studied to determine an optimal policy to be followed under all, or a subset of, circumstances.

## 3. Analyses

- In linear programming models, sensitivity analyses can be performed to determine the stability of the optimal decisions.
- Studying the shadow prices can help 'price' constraints by determining the value of increasing resource levels.
- The model can be run with different criteria, to perform 'what-if' analyses.
- Various objective functions can be considered, representing different value judgments.
- Constraints can be added or removed as required to reflect changing realities or achieve an understanding of the limiting factors.

## 4. Solution Delivery

- The model can be solved internally and results delivered, or the optimization model can be embedded in custom-built software which interfaces with existing data-systems, to constitute an end-to-end decision-making solution - all according to what best suits the client's needs
- A detailed report explaining the structure of the optimization model and its underlying assumptions, as well as a user's guide describing how to interact with the tool (if applicable) are always provided to ensure complete understanding and satisfaction.
- Training and support are available.

## Benefit from Optimization

### Better utilize human resources

Coordinate people and responsibilities to meet deadlines.

### Increase revenue or reduce operating costs

Eliminate wasted materials and improve efficiencies.

### Add intelligence to applications

Leverage software to actively help you make decisions.

### Eliminate guesswork

Enhance 'gut feeling' decision-making with proven mathematical techniques.

### Increase transparency

Succinctly encapsulate your organization's business rules.

### Get answers fast

Computer technology will assist in making rapid, accurate decisions.