

# WHATEVER HAPPENED TO OPERATIONS RESEARCH IN THE OIL INDUSTRY?

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*June 1998, reprinted June 2000*

**Answer:** It is alive and well but looks and feels different.

The oil industry was second only to the US Government in the development and use of Operations Research (OR) algorithms in the early days of the OR industry. Every oil company had its own Linear Programming (LP) models which were expanded to Mixed Integer Programming (MIP) and Non-Linear Programming (NLP) models. Large staffs were hired to develop and support these models and huge benefits were derived in terms of cost reduction, increased profits, and more efficient use of resources.

Whatever happened to those models? The answer at Exxon is that they have a new face and a new name. Optimization is still used every day and sometimes every hour. However, the optimization is now built into vendor products which are used by engineers, planners, and analysts in many departments. The industry has advanced to the point where we have put ourselves out of the LP business. It seems as though everybody is using optimization. Spreadsheet optimization in particular is widespread, including some unlikely models. The Management Science Team's response to this situation is to create, reinvent or resurrect other technology that the company can benefit from. Here is a broad overview of the of types of Management Science models currently in use at Exxon and some additional areas where opportunities could be pursued.

One effort at Exxon focuses on plant scheduling. All plants have to forecast sales for several time periods, plan for raw material purchase, make intermediate components, and package and deliver the final product. Along with this comes all the constraints of product specification, and unit specifications such as volume throughput, downtime between products, maintenance, and

inventory buildups, among others. While formally this is a MIP problem, solving it in real time is still not practical. Hence, heuristics are used through vendor supplied tools.

Other examples of OR use include Linear Optimization, Distribution analysis and Simulation. Linear Optimization is used for planning problems related to long range analysis of alternative decisions. Distribution analysis, which uses MIP, allows the optimal service of customers from the best plant while accounting for travel time, tolls, tariffs, labor laws, and costs of various transportation modes. Simulation is used for a variety of problems ranging from location of new facilities to ship movements.

Statistical analysis is also included in the Management Science umbrella at Exxon. The obvious areas are design of experiments for new products, components, or testing. Better, cheaper, and faster experiments are constantly being tested. Multivariate statistical analysis is used to trouble shoot problems in many business areas. Of course, Regression analysis is probably the most used tool in areas such as fitting property curves as well as forecasting future events.

Gazing into a crystal ball, one can see unlimited areas for use of Operations Research tools at Exxon. Areas where we can really have an impact are marketing, sales, and process control. Specific suggestions would include surveys for customer preferences, credit analysis, and early product consolidation. Use of data mining and neural networks are just in the beginning stages in the refineries to give early warning of problems and indications for improved operations.

If you want to be creative, the list is unending. But practicality sets in. While the days of large OR groups are gone, the opportunities have expanded and are vast. Our goal is to choose the right one at the right time to capture the credits worthy of these areas of OR.

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