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## Modeling Magic

IT-based operations research builds better supply chains at Procter & Gamble.

News Story by [Gary H. Anthes](#)

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[\(COMPUTERWORLD\)](#) - Operations research, the application of modeling and mathematics to business problems, had had a checkered history at The Procter & Gamble Co. since it was first tried in 1968. That all changed in 1993, when P&G hit a financial home run using the process and operations research (OR) leapt to prominence at the company.



In the early 1990s, the maker of Pampers diapers, Pert shampoo, Pringles potato chips and nearly 300 other consumer products decided to look broadly and deeply into its entire North American manufacturing and distribution network, and it tapped two IT staffers to join a team charged with reducing supply chain costs and improving efficiency. The project team developed computer models that pointed the way to a supply chain restructuring that would consolidate P&G's North American plants by 20% and lower supply chain costs by \$200 million a year.

"That project planted a seed," recalls Glenn Wegryn, one of the analysts on the project and now associate director of P&G's 17-person OR group, known as IT Global Analytics. "It really was a wake-up call about the capability you could

provide by using OR tools tied to a deep understanding of how P&G's operations worked."

While many companies put OR in their engineering or research departments, P&G put its OR group in its IT shop. "IT is one of the very few organizations within a company that has true end-to-end visibility into all the operations of the company," says Wegryn. "Part of our success is that we are a crossover capability; we have as much business knowledge as we do knowledge of our instruments and tools."

Wegryn's group works on some 100 projects a year and has worked in every P&G product category and geographic region. Most, but not all, of the problems considered by Global Analytics can be thought of as supply chain questions: How many plants should there be for this new product, and where? Where should distribution centers be located? What's the optimum transportation network? How can we deliver faster and better to these particular customers?



Glenn Wegryn, associate director of P&G's OR group  
Image Credit: Ted Rice

Global Analytics has no fixed annual budget; instead, it must find internal clients willing to fund its services. Wegryn is guarded about the financial results of individual projects, but he will say that he aims to save P&G 10 times his group's salary costs on OR projects. "We far exceed that goal," he adds.

P&G applies IT-assisted analytic techniques in three broad areas. First, it uses optimization models to determine how best to allocate supply chain resources, most often on the basis of net present value.

Second, simulation models allow P&G to mathematically try out various options to see how they might play out over time, and to test the sensitivity of results to changes in key variables. Simulation and optimization models are often used together. An optimization model may point to an option that is further evaluated and tweaked by simulating how a supply chain would behave under that option and how stable it is. "We've found that the success of a supply chain is not necessarily operating at the absolute optimal solution, but operating at one of the more robust solutions in the real world," says David Dittmann, a Global Analytics manager.

Third, the company uses decision analysis, which involves the use of techniques such as decision trees that combine the probabilities of various outcomes and their financial results.

### **Levels of Complexity**

P&G's models are implemented in several ways, depending on the complexity of

the problem. Some are written in Microsoft Excel, which is often pushed way beyond the capabilities of simple spreadsheets by commercially available add-ons. For example, P&G sometimes uses What'sBest from Lindo Systems Inc. in Chicago to build large-scale optimization models within a spreadsheet. Another favorite is PrecisionTree, a tool for building decision trees inside spreadsheets, from Palisade Corp. in Newfield, N.Y.

P&G also uses stand-alone OR packages, such as Xpress-MP from Dash Optimization Inc. in Englewood Cliffs, N.J., and Cplex from Ilog Inc. in Mountain View, Calif., which are for constructing optimization models. It uses Extend from San Jose-based Imagine That Inc. for building simulation models. Dittmann says some of the packages require programming coding rules to define objectives and constraints, for example.

While the models are developed by Dittmann and others in Global Analytics, the data is maintained and served up by traditional IT resources. Most of the information comes out of a 25TB Oracle data warehouse called SourceOne, which contains 36 months of supplier, manufacturing, customer and consumer histories by region.

But it would be a mistake to give all the credit for the success of OR at P&G to higher math and clever algorithms churning through terabytes of information. "What's really the key to OR is not just the technical side; it's also the very deep understanding of how a business operates," Wegryn says.

Indeed, the OR people at P&G say their skills as business consultants can make all the difference. Joel Kahn, a section manager in Global Analytics, says he helps his internal customers move their problems "from the gut to the head." He often begins OR projects by asking his customers these questions: What are you trying to decide? On what measure will you base a decision? What are the options? What's bothering you, and what's uncertain?

Kahn helps users answer those questions in a meeting that typically lasts a day or less. A six-month project to develop and run sophisticated models may come next, but not always. Says Kahn, "About one out of five or six times, people say, 'Now I understand it. I don't need to do any more analysis. I didn't realize my options were so simple.'" Jean Kinney, a purchasing manager at P&G, tells of the launch of a new global health care product whose success hinged on the careful choice of plant locations and sources of raw materials. "It was extremely complicated, and there were literally millions and millions of possibilities," she recalls. "If you went to the managers in the countries that would be marketing this product, they'd all say, 'Well, the plant should be located in my country.'" But if you talked to some of the corporate experts, they'd say, "But scale is important. You should build one big

megaplant somewhere.' And there were millions of options in between. So how do you come up with the best approach? Modeling techniques allowed us to do that."

To help Kinney solve the problem, Global Analytics constructed Excel-based models using Lindo's What'sBest for optimization and the Palisade's @Risk add-on module for Monte Carlo simulation, in which values for uncertain variables are randomly generated. The models sought to maximize net present value and, for each country, considered manufacturing costs, freight costs, taxes, import/export duties, local wage rates, cost of capital and more.

"At the beginning of the project, I asked all the team members to write down where [they thought] we would end up how many plants, and where would they be located," Kinney says. "No one came close."

Michael Policastro is director of customer service and logistics for P&G Global Beauty Care, and he says he has not one supply chain to worry about but hundreds combinations of suppliers, manufacturing facilities and markets. "And if you multiply that by 10 or 15 new initiatives or product launches a year, it quickly mushrooms into a hugely complex work process to design all those supply chains," he says. "Then there's the range of options open to you [in each] supply chain, so you leverage IT to help you with that process."

P&G has dozens of beauty care products, each coming in multiple sizes and package designs. Change is constant, and the tiniest modification can ripple through the supply chain. "A simple cap change may, for example, only be sourced from a Chinese supplier, and now I've added 60 days to my supply chain time," Policastro says. "What does that do to inventory levels, service levels, costs and so on?"

The complexity of his supply chains and the consequent need for automated OR techniques will only grow, says Policastro, as P&G increasingly tries to address the needs of each of the retailers it works with, as well as the needs of different groups of consumers. "A Wal-Mart hair-care shopper may not have the same needs as a Target shopper," he says. "We are now going through customer and channel differentiation and are marrying that with greater consumer insights.

"Having worked with Global Analytics for a couple of years, I think they embody the term *IT* information technology very well in the sense that they couple not just the technology of analytics, modeling and options analysis with information, but also with the knowledge of key supply chain information such as import duties, the latest tariff regulations, trends in labor costs, and P&G manufacturing principles," Policastro says.

He says it's good that Global Analytics must fund itself by finding paying customers

inside the company. That way, he explains, "their survival depends on the quality of their services."

#### CASE STUDY

### Procter & Gamble

**Incorporated:** 1837

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**Annual revenue:** \$51B

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**Employees:** 98,000

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**Products:** Nearly 300 brands in 140 countries

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**Billion-dollar brands:** Crest, Charmin, Head & Shoulders, Tide, Pringles, Pampers and 10 others

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**Plants:** 140



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