

## REAL WORLD CASE 3

# Procter & Gamble and Others: Using Agent-Based Modeling for Supply Chain Management

When it comes to IT projects, it doesn't get much better than this: Procter & Gamble Co. (www.pg.com) saves \$300 million annually on an investment of less than 1 percent of that amount. Indeed, P&G's use of agent-based modeling helped it transform its supply chain system so fundamentally that the company no longer even calls it a supply chain. The Cincinnati-based maker of over 300 consumer products now calls its connections to 5 billion consumers in 140 countries a "supply network." "Chain connotes something that is sequential, that requires handing off information in sequence," says Larry Kellam, P&G's director of supply network innovation. "We believe it has to operate like a network, like an internet, so everybody has visibility to the information."

Many of the insights that have enabled P&G to transform a chain into a network come from agent-based computer models it developed with the BiosGroup, recently acquired by NuTech Solutions Inc. (www.nutechsolutions.com). Their work is a real-world example of what mathematicians call "agent-based modeling of complex, adaptive systems." The idea is that many systems that are enormously complex overall are in fact made up of semiautonomous local "agents" acting on a few simple rules. By modeling and changing the agents' behavior, one can understand and optimize the entire system.

In P&G's computer simulations, software agents represent the individual components of the supply system, such as trucks, drivers, stores, and so on. The behavior of each agent is programmed via rules that mimic actual behavior, such as, "Dispatch this truck only when it is full," or "Make more shampoo when inventory falls to  $x$  days' demand." The simulations let P&G perform what-if analyses to test the impact of new logistics rules on three key metrics: inventory levels, transportation costs, and in-store stock-outs. The models considered alternate rules on ordering and shipping frequencies, distribution center product allocation policies, demand forecasting, and so on.

"Some of the conclusions were surprising, and some confirmed what we believed but didn't have the data to support," Kellam says. For example, he says, the models showed that it would often be advantageous to send out trucks with less than full loads, something P&G almost never did before. Although transportation costs would be higher as a result, P&G could more than make that up by reducing the frequency of in-store stock-outs, which often result in lost sales. "Agent-based modeling convinced us of some changes we fundamentally had to make if we were to be flexible and adaptable," Kellam says, explaining that changes fell into the following three broad areas:

- Relaxation of rigid rules, often counterintuitively, in order to improve the overall performance of the supply network. That required some cultural changes, such as convincing freight managers that it's sometimes OK to let a truck go half-full.
  - More flexibility in manufacturing. As a result of insights gained by the models, P&G is "fundamentally retooling" its manufacturing processes so that it no longer produces long runs of a single product but instead is able to produce every product every day. The benefits include fewer stock-outs and happier customers.
  - More flexibility in distribution. For example, it's possible to restock a retailer in 24 hours rather than the customary 48 to 72 hours.
- P&G uses supply chain management software from SAP AG, but it turned to BiosGroup's agent modeling technology when its long efforts to decrease inventory levels produced only marginal improvements. Agent-based modeling, while not yet commonplace, is catching on, especially at companies with large, complex supply or transportation networks. In addition to P&G, the following companies have tried it and cite benefits that include cost savings, reduced inventories, and better customer service:
- Southwest Airlines Co. used software agents to optimize cargo routing.
  - Air Liquide America LP, a Houston-based producer of liquefied industrial gases, reduced both production and distribution costs with agent-based modeling.
  - Ford Motor Co. used agents to simulate buyer preferences, suggesting packages of car options that optimized the trade-offs between production costs and customer demands.
- Computer modeling of supply chain operations, like that done by BiosGroup and P&G, today requires a combination of custom software development and consulting. But that could change as a result of a development agreement that P&G had fostered between SAP and BiosGroup. SAP has already demonstrated a prototype agent capability in its replenishment software. SAP may introduce the prototype technology in its products, Knoll says, but for now it's helping a few key customers try it out on a project basis.

### Case Study Questions

1. Do you agree with Procter & Gamble that a supply chain should be called a supply network? Why or why not?
2. What is the business value of agent-based modeling? Use P&G and other companies in this case as examples.
3. Visit the website of NuTech Solutions. How does NuTech use AI techniques to help companies gain "adaptive" business intelligence? Give several examples from the website case studies.

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