Analytics Operations Engineering, Inc.

Consulting firm applies advanced quantitative methods to solve challenging operations problems.

Members of the AOE Consultant and Analyst team, including CEO Tom Svrcek (front row, fourth from left), founder Mitchell Burman (back row, fifth from left) and co-founder Jim Schor (front row, second from right).

As you exit an eighth-floor elevator, Boston's Financial District transforms into what feels like a university research lab: offices adorned with academic textbooks surround young employees receiving scholarly advice from senior mentors. Their efforts to crack the code of a new algorithm resemble the graduate research process. This is neither a university nor research lab, however. Analytics Operations Engineering (AOE) is a consulting firm passionate about bridging the gap between Ph.D.-level theory and the practical application of advanced analytics. While other firms are just beginning to realize the importance of data visualization in what they call analytics, AOE has been applying optimization, control theory, stochastic analysis, simulation and data-mining models to business challenges in operations, logistics, and marketing for more than 20 years.

AOE's projects focus on reducing working capital, improving the customer experience and increasing profits for clients. Its consultants work on assignments that range from providing services to direct clients, to supporting projects at large management-consulting firms, to portfolio work for multiple private equity groups in their efforts to cut costs and improve the balance sheets at their portfolio companies. By conducting sophisticated analyses at the most detailed level, AOE leverages big data to identify profitable improvements with the highest confidence and precision. In addition to delivering insights and analyses, AOE often produces custom-made software solutions for clients to use in their strategic, tactical and operational decision-making processes.

Company History

Mitchell Burman and James Schor founded AOE in 1994 while they were graduate students under the guidance of Dr. Stanley Gershwin at MIT, working together on real-time scheduling projects for manufacturers including Johnson & Johnson, Boeing and Hewlett-Packard. These projects included building a capacity-evaluation model that ran in seconds instead of months for the HP inkjet-printer division. This allowed Burman and his HP associates to identify bottlenecks that were disrupting production and to propose changes to sharply improve production with little added cost. With the demand for printers exploding, their solution resulted in $280 million in increased sales, and the project was a finalist for the 1997 Edelman Prize. This experience led Burman, Schor and

All About the Roundtable

The Roundtable consists of the institutional members of INFORMS with member company representatives typically the overall leader of O.R. activity. The Roundtable is composed of about 50 organizations that have demonstrated leadership in the application of O.R. and advanced analytics. The Roundtable culture is peer-to-peer, encouraging networking and sharing lessons learned among members.

The Roundtable meets three times a year. Roundtable goals are to improve member organizations' OR/MS practice, help Roundtable representatives grow professionally and help the OR/MS profession to thrive. Further information is available at http://roundtable.informs.org.

The Roundtable also has an advisory responsibility to INFORMS. According to its bylaws, "The Roundtable shall regularly share with INFORMS leadership and advise the INFORMS Board on its views, its suggested initiatives and its implementation plans on the important problems and opportunities facing operations research and the management sciences as a profession and on the ways in which INFORMS can deal proactively with those problems and opportunities." The Roundtable meets with the INFORMS president-elect each spring to discuss practice-related topics of interest to him or her, and with the entire INFORMS Board each fall to discuss topics of mutual concern.

This series of articles aims to share with the INFORMS membership at large some information and insights into how O.R. is carried on in practice today.

Gershwin to create AOE. By selecting top consultants with diverse academic and business backgrounds while rapidly building its clientele, AOE became a company whose achievements led to it being named to *Inc. Magazine's* list of America's fastest growing companies in 2002.

While starting with an emphasis on improving supply chains, leaning production systems and solving routing problems, the firm eventually expanded its focus to other business issues that could be addressed with rigorous quantitative methods. Unlike boutique firms that specialize in specific verticals, AOE consultants apply their techniques to a wide variety of problems and industries. In recent years, AOE has built up its expertise in big data by generating value in areas such as customer segmentation and retention, promotion optimization, cross-selling, pricing strategy and revenue management. Regardless of the application, AOE's projects remain focused on reducing working capital, improving the customer experience and increasing profits for its clients.

Examples of Success

Data mining for customer segmentation in retail. A big-box retail chain with terabytes of customer-purchase data wanted to know whether its marketing was helping the company's profitability. AOE consultants spent six weeks analyzing three years' worth of customer data and found that regular discounts were needlessly shrinking the retailer's profit margins on items their customers would have purchased anyway.

AOE consultants segmented the customers, defining 12 different behavioral patterns. By looking at customers over time, they also were able to determine that certain types of customers who started with one category of product were most likely to buy a predictable second category of product.

AOE proposed that the retailer give customers coupons for specific product categories that they didn't usually buy. By crafting attractive discounts for new purchases in "next best product" categories, they preserved margin on the products the customer was already buying and increased revenues on products the customer may not have bought otherwise. AOE managed the pilot program and demonstrated that margins were improved by 8 percent, resulting in an overall increase in profit.

Custom-made tools for managing manufacturing operations. A semiconductor firm was unable to predict the impact of accepting new orders at a major fabrication plant. It was unclear whether filling a new order would cause bottlenecks at certain machines and delay shipments for other high-priority customers.

AOE consultants developed a customized simulation tool for the plant that quickly ran through thousands of production simulations, including set-up times, run times, stochastic downtimes, even strategic options such as buying new machines. The simulations showed the impact of new orders on the deliveries of existing orders. The tool, now regularly used by the factory managers, has boosted throughput while improving customer satisfaction.

Tools for pricing. When a private-equity firm bought a national retail apparel chain with hundreds of mall-based stores, it wanted to determine the optimal discounting strategy to move unsold merchandise during their fashion season. The company had ample data on chain-wide sales of each item, and set new 10 percent or 20 percent discounts every four weeks using a standard industry software package.

AOE consultants modeled the retailer's sales over time, adjusting for special factors such as holiday/seasonal promotions. The model showed sharply varying patterns for different items. For example, branded T-shirts were highly responsive to price cuts, while socks showed little sensitivity. AOE used the model to study two years of individual store transactions around the country. It became clear that price cuts in tiny suburbs of New York and Washington had a much lower impact than they did in Midwest malls.

Based on AOE's analysis, the chain decided to run smaller, 5 percent markdowns in stores where sensitivity was low and other strategies in areas with greater sensitivities. AOE built a price-optimization model that sets strategy for individual stores and product categories, based on price elasticity and store-specific inventories. The model and corresponding software allow the company to increase its gross margins by 3 percent to 4 percent compared to the methods they were using previously.

Analytics Operations Engineering Today

AOE has recently promoted Tom Svrcek to the leadership role of CEO. It continues to grow, hiring consultants and analysts directly from top academic programs, as well as individuals with strong academic backgrounds and extensive professional experience; most have Ph.D.s in mathematics or operations research and have taught at prestigious institutions including MIT, The Wharton School and Columbia University. They have written multiple books and articles on supply chain, data mining and systems engineering and have several times been finalists for a number of awards in O.R., including the Edelman Prize and the Wagner Prize.

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In 2009, AOE began an analyst-cultivation program by recruiting graduates with bachelor's degrees in mathematics and related fields from schools such as Harvard, MIT, Princeton and Yale. AOE believes part of its mission should be to attract young talent to the field, and to demonstrate that there are interesting and rewarding careers outside of Wall Street and traditional consulting. After two or three years with the firm, analysts are encouraged to further their education or careers in industry and consulting.

Because of the training and experience they received at AOE, the first few graduating classes of analysts have found opportunities in companies including Google, Facebook, Rue La La and Whole Foods, and have been accepted in graduate programs in operations research at U.C. Berkeley, Carnegie Mellon, MIT and NYU.

Dimitris Bertsimas, program director MIT's Operations Research Center (ORC), said, "We have admitted two AOE analysts this year to the ORC's Ph.D. program. Given their strong academic credentials and practical modeling experience, we expect them to thrive in our program."

Within the last year, AOE has also created its own internal incubation laboratory to encourage its people to invest in more broadly commercializing the company's two decades' worth of existing intellectual property. Using internal resources, consultants with entrepreneurial drive can build commercial models and tools that leverage the firm's existing IP and receive additional compensation if the concept is a commercial success. The lab benefits consultants by providing an additional outlet for their intellectual curiosity – with the potential upside of additional income – while maintaining the security, stability and intellectual challenge of its core business.

Future

As it celebrates its 20th anniversary, AOE continues to thrive while applying the most sophisticated analytic techniques to help businesses improve both their top and bottom lines. In the era of big data, its consultants produce analyses that move far beyond the techniques on which operations research was grounded.

Customers have always sought cost-cutting techniques, but they increasingly seek analytic solutions to aid decision-making. Consultants at AOE combine business knowledge, communication skills and unparalleled technical leadership to quickly deliver tools clients need to succeed in the 21st century. **ORMS**

Mitchell Burman founded Analytics Operations Engineering in 1994 and serves as its president, providing the strategic direction of the company. He received a Ph.D. and a master's degree in operations from the Massachusetts Institute of Technology. Lauren Berk is an analyst at AOE and holds a bachelor's degree in mathematics from Yale University.

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