

## **Strategic Analytics**

With the recent growth in availability of data and inexpensive analytical tools, any forward-thinking enterprise can mine the potential of these powerful methods for themselves. Here is what you need to know to get started.

*By Yuri Levin and Jeffrey McGill*

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## About the authors

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**QSB** Insight

## “If we don't invent an answer to this we're history..”

These fateful words are attributed to Donald Burr, the energetic CEO behind the PeopleExpress airline phenomenon of the mid-1980s. Burr started the airline in 1981 and over the next four years led it through exceptional growth to revenues nearing \$1 billion – reportedly the fastest growth of a U.S. company in history to that time. The company worked with a lean workforce and minimal overhead, and provided ‘no-frills’ service. This allowed it to offer air fares significantly lower than those of any major competitor. By 1985, PeopleExpress was the fifth largest U.S. passenger carrier and was directly challenging major U.S. airlines in many of their key markets. What Burr needed to “invent an answer for” was an extraordinary action taken by American Airlines. In January of 1985, American introduced deep discount fares across its flight network, including every route flown by PeopleExpress. American was a full-service airline with much higher fixed costs than those of PeopleExpress. How could it sustain these prices without threatening its own survival?

American's secret was its new ‘yield management’ system, which permitted it to maintain or increase its profitability while lowering fares for significant amounts of seat inventory on nearly every flight. This was not short term ‘predatory pricing’ at a loss – the airline could sustain these prices until PeopleExpress either responded by increasing their service levels (and prices) or went out of business. PeopleExpress attempted to change its business model but ultimately failed. Burr was forced out of business two years later.

This is a classic example of what has been called Strategic Analytics – detailed, data-driven, analyses supporting outcomes of strategic importance for a company. In the case of American Airlines, the analysis involved careful calculation of the number of seats on each flight that could be sold early at low fares without excessive revenue loss from late-booking high-fare customers. These calculations depended critically on the probabilities or odds of future levels of passenger demand for full and discount fares based on computer records from thousands of past flights. In effect, Dallas-based American played a winning game of Texas Hold-em against an ill-equipped competitor.

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The type of strategy deployed by American Airlines was distinctly different from usual 'big picture' strategic actions, in that it dealt with multiple small, rather than single and large, decisions. Those small decisions were whether or not to accept individual passenger bookings in different fare classes for flights that could be departing months in the future. American controlled hundreds of flights per day, each carrying hundreds of passengers, so there were tens of thousands of such decisions per day. The strategic decision was to apply analytical methods to those thousands of decisions. This required recruiting highly trained personnel and an investment of over \$100 million in computer systems that were capable of playing the odds like seasoned poker players. American subsequently reported revenue gains of \$1.4 billion over three years directly attributable to their yield management system. In this respect there is a similarity to conventional big picture strategy – the decision to develop and deploy this automated technology for low-level operational decisions was made at the highest levels of the organization – clearly a decision of strategic importance.

We can distinguish two types of strategic analysis – the special, one-off, analyses required for major decisions; for example, corporate alliances, market expansions, new product lines, major acquisitions, and so on; and automated analyses for multiple, repeated decisions like those in the revenue management setting. There is nothing really new in either case. Extensive analyses in support of major decisions have been normal practice for senior managers for generations, and mathematical approaches to repetitive decisions like those of inventory control and resource allocation have been available since early in the last century. Entire technical fields like industrial engineering, operations research, and management science have developed to expand knowledge and techniques in both areas.

It is not hard to guess what is new – there are now amounts of data available for both types of strategic decision that are unprecedented, both in quantity and timeliness. For example, point-of-sale terminals allow retail organizations to measure minute-by-minute changes in sales of products or services. That torrent of data can be directed into data warehouses and subsequently analyzed in

support of future decision-making. Furthermore, widely available online databases allow large or small enterprises to quickly gather information about their competitive environments. Such data as population demographics, geographic distributions and distances, trends, and economic factors that were costly and difficult to assemble just a few years ago are now available in a matter of minutes.

Another new factor is the increasing availability of powerful analytical tools. The tools can be as complex as special-purpose systems costing millions of dollars or as simple as the database and spreadsheet programs found in nearly every desktop computer. Managers in both large or small enterprises, service or manufacturing, private or public, are just beginning to learn how to exploit the data and tools they have at their disposal to improve decision-making.

To summarize: in our view, strategic analytics is really just a new term for practices that have been around for decades. Because of limitations in data, tools, and training, their use has been restricted to special applications in large, technically adept companies. The recent growth in availability of data and analytical tools make it essential for any forward-thinking enterprise to begin exploring the potential of these powerful methods for themselves.

## Strategic Analytics: Addressing Key Concerns

### **Is strategic analytics just another fad?**

There is certainly hype around anything new (or re-born), but it does not seem as if the factors supporting analytics – availability of data and analytical tools – will disappear. The airline yield management story began in the 1970s, and there is no sign the expansion of these systems is slowing down 40 years later. Our bet is that successful organizations of the future must learn which analytical tools are useful for them and which ones can be ignored.

### **I don't happen to own an airline. Is there really anything here for me?**

Definitely! Airline yield management (now more commonly called 'revenue management' or RM) is just a well-known example of successful analytics. The early emergence of a winning application such as RM in the airlines can be directly linked to the pre-existing necessity to develop sophisticated computer reservations systems. In the time since the early airline systems, RM has spread to many other types of service operations: passenger rail, cruise lines, hotel/motel accommodations, car rentals. All have a similar central problem: capacity (such as airline seats) that is 'perishable', that is, wasted if not used on a particular day. The essence of RM, then, is how to maximize revenues from perishable assets through differential pricing. It is difficult to picture any service or production system that does not have perishable capacity – "use-it-or-lose-it" applies everywhere. Any of these situations have the potential for variations on revenue management. Beyond RM, there are hundreds of other analytical opportunities for companies.

### **This sounds like something suitable for medium to large enterprises, but not for small operations like mine.**

This was largely correct up to a few years ago, but the arrival of inexpensive tools on desktop computers, particularly database and spreadsheet programs, makes sophisticated analytics possible for anyone. For example, it is entirely feasible for a small business to improve profitability with analytical pricing and inventory control. All that is required is willingness to learn new techniques and engage in experimentation. Not all methods are right for all operations, but there are almost certainly some that can make a genuine contribution.

## **What is the relationship between strategic analytics and business analytics?**

Business analytics could be considered just another term for strategic analytics but has become more closely associated with 'data mining'. Data mining encompasses a range of techniques for combing through large databases looking for hidden relationships or patterns that can inform decision making. There is a natural synergy between these two: data mining can identify new potential areas for analytics, while analytics generate important questions that can focus data mining searches.

## **Aside from revenue management, what other types of analyses are available?**

Here is a sample of widely-used methods:

**Simulation Modeling:** Preparation of a simplified computer model of a system that permits experimentation with different changes to the system and estimation of their effects on important outcomes. For example, a spreadsheet model of costs and revenues for a product or service can help with decisions about supplier choice, cost reduction, or pricing. It is now straightforward to add uncertainty to such models so that risks can also be explored.

**Regression Analysis:** A group of powerful statistical methods for estimating the strength of relationships between different variables; for example, the relationship between sales and related variables such as prices, advertising expenditures, or seasonal factors. A successful model of this type can help with prediction of the future effect on sales of current pricing and other actions that are in management control.

**Decision Trees:** Schematic diagrams that help visualize and evaluate sequences of decisions and the likelihoods of different possible outcomes. Such trees, for example, can be very useful for decisions around downstream contingency plans that depend on the outcome of earlier decisions or events.

**Multi-factor Decision Analysis:** Tools and techniques for complex decisions that require balancing competing objectives; for example, minimizing environmental impacts, minimizing costs, or maximizing customer satisfaction or health and safety. This characterizes many different types of decisions, but is particularly common in public policy decision-making.

**Optimization:** A broad range of quantitative techniques for finding values of decision variables that optimize some measure of success – typically minimum cost or maximum profit. Such methods are frequently used to find the minimum cost supply points for a set of geographically dispersed destinations when supplies have constrained capacities, and demand points have specified quantity requirements.

**Risk Analysis:** Methods for assessing the risk of possible decisions in situations of future uncertainty. A classic example is that of balancing risk and returns in investments.

**Optimal Scheduling:** A perennial problem for managers is staffing and scheduling in such a way as to maintain acceptable service or production levels while minimizing labour costs. Airlines have reported millions of dollars q years in savings with advanced crew-scheduling programs. For smaller organizations, such problems can be attacked with optimization techniques that can be implemented in spreadsheets.

**Inventory Control:** Choosing quantities to order that optimally balance the cost of holding inventory versus the cost of placing and handling each order. Such methods, when applied across hundreds of items, can achieve substantial long run cost-savings.

## **How do I get started with this? Are costly consultants necessary?**

The usual — and sensible — advice is to start small, with a clearly defined problem. The need for consultants is determined by the level of comfort you or your colleagues have with analysis and your willingness to learn by yourselves. It can sometimes help to bring in a consultant at the onset for initial guidance, but then to try and develop initiatives on your own or hire someone with the right skill-set. The more you develop analytics in-house, the more you will understand and own the process.

## **Useful Links**

### **Analytics Magazine**

<http://analytics-magazine.org/>

### **Association of Asian Pacific Operational Research Societies**

<http://www.apors.ms.unimelb.edu.au/>

### **Association of European Operational Research Societies (EURO)**

<http://www.euro-online.org/web/pages/1/>

### **Canadian Operational Research Society (CORS)**

<http://www.cors.ca/>

### **Institute for Operations Research and the Management Sciences (INFORMS)**

<http://www.informs.org/>

### **Institute of Industrial Engineers**

<http://www.iienet2.org/Default.aspx>

### **Decision Sciences Institute**

<http://www.decisionsciences.org/>

### **International Federation of Operational Research Societies (IFORS)**

<http://www.ifors.org/>

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