Strategic Analytics

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

These fateful words are attributed to Donald Burr¹, the energetic CEO behind the PeopleExpress airline phenomenon of the mid-1980’s. Burr started the airline in 1981 and over the next four years led it through exceptional growth to revenues nearing one billion dollars – 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, and Burr was forced out of business two years later.

This is a classic example of what has been called Strategic Analytics² – 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.

The type of strategy deployed by American Airlines was distinctly different from usual ‘big picture’ strategic actions in that it dealt with multiple small, not single 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. 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

¹ (Cross, 1997, p. 118)
² (Davenport, The Rise of Strategic Analytics, 2009)
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.

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Strategic Analytics – Q & A

Here’s some ‘question and answer’ regarding analytics.

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 particularly well-known example of successful analytics. The early emergence of a winning application like RM in the airlines can be directly linked to their pre-existing necessity for sophisticated computer reservations systems. Airlines were naturally positioned to begin applying their information systems capabilities far beyond their original simple record-keeping purposes. In the time since the early airline systems, RM has spread to many similar types of service operations; for example, passenger rail, cruise lines, hotel/motel accommodations, and car rentals.

All of these have a similar central problem: capacity (like 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 actually difficult to picture any service or production system that doesn’t 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 literally hundreds of other analytical opportunities for companies. Some examples of successful applications of analytics can be found in recent books: Davenport & Harris, 2007, and Baker, 2008. Some other possibilities are discussed, below.
This sounds like something suitable for medium to large enterprises, but not for small operations like mine. Is that correct?

This was largely correct up to a few years ago, but the existence 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 some ‘experimentation’. Not all methods are right for all operations, but there are almost certainly some that can make a genuine contribution.

Is strategic analytics just another fad, or buzz-word?

There is certainly lots of hype around any new (or re-born) ‘wave’, but it doesn’t seem like the factors supporting analytics – availability of data and analytical tools – are going to disappear. The airline yield management story began in the 1970’s – there is no sign that the expansion of these systems is slowing down forty years later! Our bet would be that successful organizations of the future must learn which analytical tools are useful for them and which ones to ignore.

Strategic analytics sounds a lot like ‘business analytics’ – what’s the relationship?

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 generates important questions that can focus data mining searches.

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

That’s quite a long list; here’s a sample of widely used methods:

Simulation Modeling:
preparation of a simplified computer ‘model’ of a system which permits experimenting with different changes to the system and estimating 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 like prices, advertising expenditures, seasonal factors, and so on. 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 to help visualize and evaluate sequences of decisions and the likelihoods of different possible outcomes. For example, such trees can be very useful for decisions when downstream contingency plans are possible that depend on the outcome of earlier decisions or events.

Multifactor Decision Analysis: Tools and techniques for complex decisions which require balancing competing objectives; for example, minimizing environmental impacts, minimizing costs, maximizing customer satisfaction, maximizing health and safety, and so on. 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. For example, 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 that of 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 per 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.

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**How does one get started with this? Do I need to spend a ton of money on consultants?**

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 beginning to get some initial guidance, but then try to develop things on your own or hire someone with the right ‘skill-set’. The more you develop things in-house, the more you will understand and ‘own’ the process.

Davenport and Harris\(^4\) provide extensive guidelines for achieving what they term the level of ‘analytical competitors’. Most of their discussion seems targeted to large organizations, but there are many useful hints for organizations of any size. Also, there is now a free online magazine devoted to analytics: AnalyticsMagazine.com. You can subscribe at http://analytics.informs.org. A new series in that magazine is devoted to exactly the problem of “making analytics work” (Boyd, 2009).

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**Where can I learn more about this?**

A great place to find out more is any of the national and international web-sites of related societies. Here is a partial listing:

Canadian Operational Research Society (CORS): http://www.cors.ca/
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/
Association of European Operational Research Societies (EURO): http://www.euro-online.org/display.php?page=welcome

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4 (Davenport & Harris, Competing on Analytics: the new science of winning, 2007)

**References**