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Analytics

DRIVING BETTER BUSINESS DECISIONS

NOVEMBER/DECEMBER 2011

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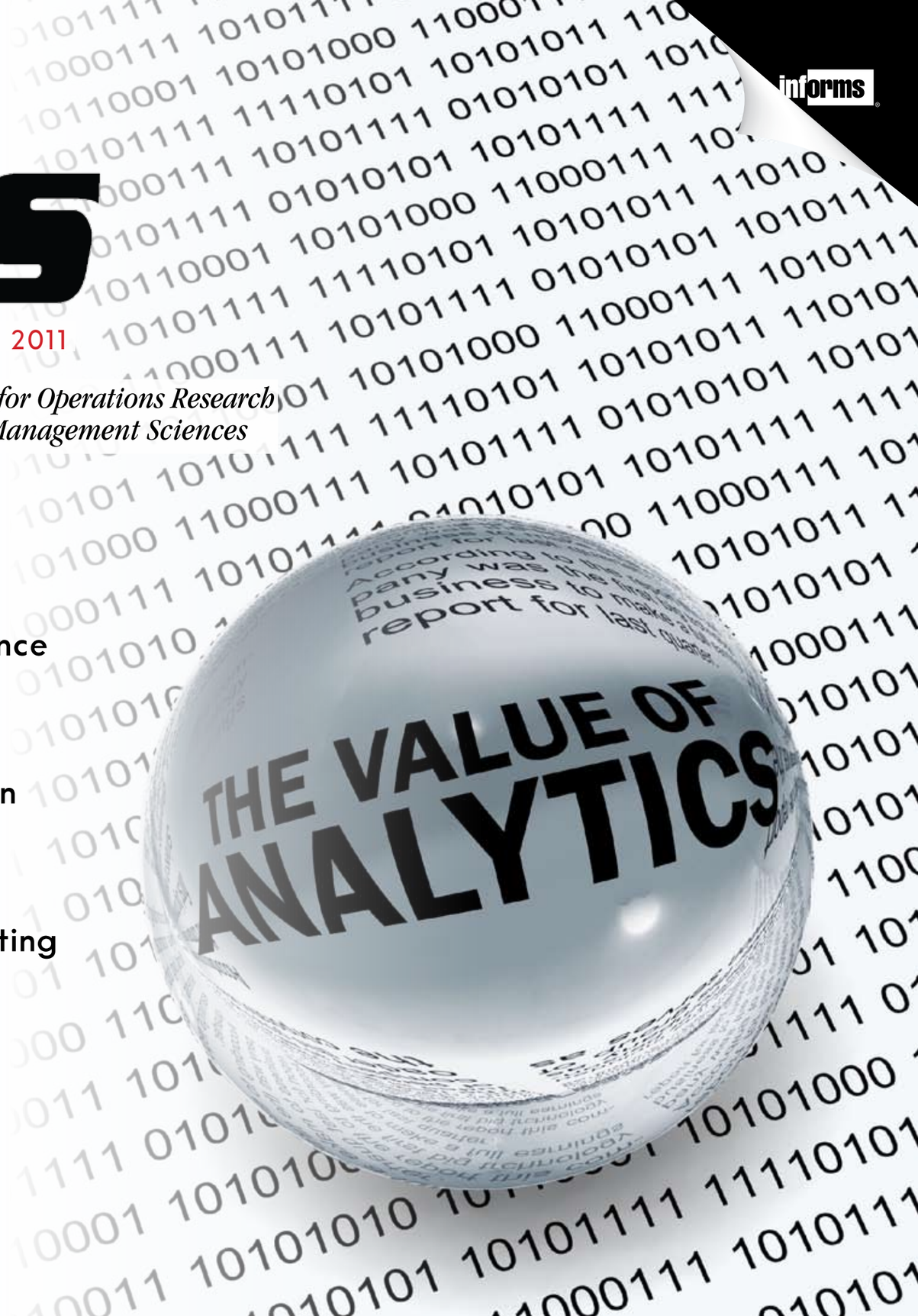

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Executive Edge
Chris Fry of Strategic Management Solutions closes the gap between analytics and action

The art of the analytics deal

How can you sell "analytics" if you don't know the value of the product or service you're trying to sell and you don't know anything about sales? That's a problem many analysts face, and it's a problem several contributors tackle in this issue of *Analytics* magazine.

Evan Stubbs, who literally wrote the book on the subject ("The Value of Business Analytics: Identifying the Path to Profitability"), says that the "best-guarded secret in business analytics is that, in practice, its success comes down not only to organizational culture but also to the ability of managers to successfully sell the value of analytics." In our cover story, Stubbs outlines four common mistakes that analysts make when defining the value of analytics.

Concludes Stubbs: "Dealing with [the] data deluge requires … developing the ability to selectively process information based on value, not sequence. It requires, more than anything else, the realization that brute-force and manual effort are, in the long run, an impossible solution. Quite simply, it requires the effective application of analytics."

The critically important but often overlooked ability to "sell" analytics is one of a long list of skills David Leonhardi explores in "Soft skills: The 'killer app' for analytics." Leonhardi classifies "soft skills" as "the right-brain interpersonal/personal skills that cover a large continuum of proficiencies" such as communication, conflict resolution and negotiation, creative problem-solving, strategic thinking and team-building.

A business strategist in Boeing Commercial Airplane's Strategy Integration Group, Leonhardi builds on an article by Freeman Marvin and William Klimack ("Six soft skills every analyst needs to know") that appeared in the January/February 2011 issue of *Analytics*. In his article, Leonhardi outlines six new abilities (design, story, symphony, empathy, play and meaning) that have a role in the "selling" process.

Making the sale is one thing, making an impact is another. In his Executive Edge column, Chris Fry, managing director of Strategic Management Solutions, examines why so many analytics projects fail to reach their full potential and offers three strategies to close the gap between analytics and action. As Fry notes, "The challenge for many of us who love analytical work is that it can be easy to get lost in the excitement of looking at data or building a model and lose track of the critical importance of enabling decisions and actions from our work."

– PETER HORNER, EDITOR
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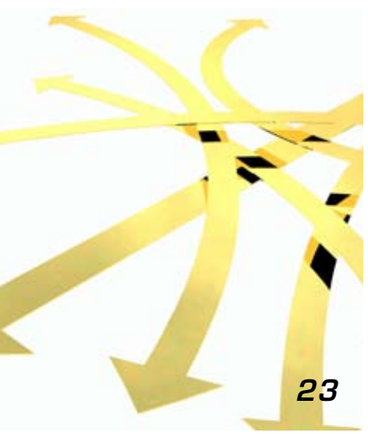

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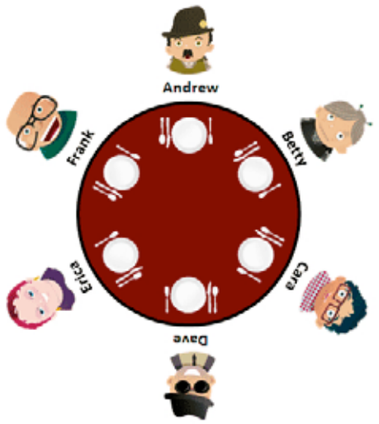

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Closing the gap between analytics and action

Countless analytics efforts fail after months of effort are spent developing some beautiful model because nobody took the time up front to answer key questions.

BY CHRIS FRY

Analytics is on the minds of executives more than ever before. Data are becoming more accessible, computing power is increasing to the point where we can actually crunch those data, and analytical software tools are becoming increasingly powerful and cost-effective as well [1].

With such an ideal environment, analytics should be having a massive impact on business performance. Many analytics efforts do have great impact [2], but too many seem to never reach their full potential. How many times have you heard the story of the analyst who comes up with a great concept or model, but the affected decision-makers have never heard anything about it, cannot understand it or are unable to "operationalize" it?

In my view, such efforts do not reach their full potential because the analysts and project managers haven't closed the gap between analytics and action. To achieve the greatest impact in our profession, we must work hard to ensure that analytical work leads to action. We must create buy-in for our work, and make each recommendation as actionable as possible.

I have observed several strategies that can help to ensure impact from analytical work. Here are three of them.

1. Start with the process.

Analytics work does not always require process changes, but often it does. When an analyst designs a model to inform a repeated decision, for example, he must think about how the decision-making process will need to change to take advantage of the analytical solution.

Improving performance through analytics often requires careful integration of the analytics solution into business processes. We have seen countless analytics efforts fail after months of effort are spent developing some beautiful model because nobody took the time up front to answer questions such as:

- Who is going to use the model?
- What benefit will the user(s) gain by using the model?
- Do the user(s) have time to use the model?
- Who is going to maintain the model?
- Where are we going to get the data needed to feed the model?
- How will the data get into the model?
- Do the model outputs answer the right questions?
- Can the model outputs be explained easily? Who will explain them?

A more effective approach involves starting with key process changes first and then adding analytical sophistication over time as needed and at the pace it can be absorbed.

As an example, my team recently developed a revenue management solution for a client whose organization had little prior experience with revenue management. We began by working with the client's management team to define how a revenue management approach could work for their industry and business, and laid out a roadmap for how to put it together.

The initial solution used relatively simple analytics, mainly focused on providing visibility to critical pricing data that had not previously been readily available, with a recommendation algorithm based on a simple heuristic. We spent a significant portion of our time setting up the infrastructure for their organization to use the solution, including:

- Codifying the approach into a reusable model and working with the client's IT department to automate data feeds into the model.
- Providing training to the client's users. In our case this involved running more than 10 in-person training sessions for user groups across the U.S. The goal was as much to convince them of the value in changing their process as it was to train them on the specifics. It was time well spent to ensure that the solution was adopted.
- Clearly defining roles, responsibilities, metrics and incentives for users and management involved in the process.
- Clarifying the product definition structure to take better advantage of revenue management.
- Staging the rollout across several test markets so that we could tweak the process over time.

At present, the client has a system up and running with more than 500 users across the U.S. accessing and deriving benefit from it daily. And since the process infrastructure was laid first, we are now able to layer on additional analytical sophistication into that infrastructure. I suspect that our effort could not have been nearly as successfully adopted if we had not put as much energy into process development and deployment as we did.

2. Lift up the hood.

We find we are most successful at moving clients to action when we provide analytics that give them confidence in their decisions. This often means going to great lengths to achieve analytical transparency – making it clear what assumptions are made, what the data show and how the result is derived. Beware the black box. If our goal is to inform action, our analysis should enable us to explain why an action is appropriate, and it should do so in terms that decision-makers and stakeholders can understand.

My favorite way to achieve this type of transparency is through pictures (i.e., charts and graphs). Models can build insight by showing graphically how their outcome would change under alternate decisions or under a range of uncertain scenarios. Charts or graphs can also provide insight into how a model outcome is derived in the first place [3].

When we build forecasting applications, for example, the forecast is typically only a small portion of the total information set provided as model outputs. We may include a graphical view of input data and assumptions, as well as intermediate outputs showing each step of the calculation for any product, demand segment, etc. When appropriate, we'll include ranges and show how input uncertainties drive output uncertainties. Our goal is to build models that explain themselves to users – in many ways the opposite of a black box.

3. Highlight the "so what's."

It's hard to close the gap between analytics and action if your analytics don't make it clear what action you want the user to take, or what conclusion you wish your user to draw from the information they're seeing. Analytical applications or reports that provide information, but do not provide guidance on how to interpret

the information, are focused on the "what" but not the "so what." Take for instance a reporting tool that lists inventory levels on all products in a warehouse at the end of each day. That's the "what." Layer into the report an extra line that indicates which products need to be reordered, and now you have the "so what" – an output that is much more actionable.

Some examples of highlighting the "so what's" in data that have worked well for me and my colleagues include:

- Superimposing a "target line" on a bar or scatter graph to illustrate which items have met a certain performance objective.
- Highlighting metrics in a dashboard when their values are outside of a designated control window.
- Using conditional formats or sparklines in data tables to highlight trends.
- Simply drawing a box around recommendations or items requiring special attention.

It can take some creativity to come up with the best way to draw a user's attention to the "so what's" from an analysis or model, but often this can make the difference between analytics that focus users on value-creating actions and those that simply create information overload.

I hope these recommendations serve as a good reminder of what many consider to be a common-sense approach to deploying analytics. The challenge for many of us who love analytical work is that it can be easy to get lost in the excitement of looking at data or building a model and lose track of the critical importance of enabling decisions and actions from our work. Closing the gap between analytics and action can lead to greater impact for organizations, as well as a more rewarding experience for the practitioner. ▮

Chris Fry *(chris@strategicmgmtsolutions.com) is managing director of Strategic Management Solutions, a Redwood Shores, Calif.- based business analytics consulting firm specializing in pricing, forecasting, supply chain strategy, and product complexity management. He was awarded the 2009 Franz Edelman Award for Outstanding Achievement in the Practice of Operations Research and Management Science by INFORMS for his contributions to product portfolio management initiatives at Hewlett-Packard.*

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1. A number of recent publications have documented the rise of business analytics. See for example: Davenport, Thomas H. and Jeanne G. Harris, 2007, "Competing on Analytics: The New Science of Winning," Harvard Business School Press.

2. See this year's Franz Edelman Award special issue of *Interfaces* for examples of world-class, high-impact analytics projects: *Interfaces,* Vol. 41, No. 1, January-February 2011.

3. For example screen shots of models designed to give a look under the hood, see T. Olavson and C. Fry, "Spreadsheet Decision Support Tools: Lessons Learned at Hewlett-Packard," *Interfaces,* Vol. 38, No. 4, July-August 2008.

A winning analytics team

Not even Google can explain the placement of any particular ad other than to describe its ad placement algorithms – which, of course, it doesn't do since businesses could take advantage of this information. Google does, however, provide a variety of tools – some quite sophisticated – for businesses to track how their ad campaign is performing.

BY E. ANDREW BOYD

I met Erin Blatzer for lunch near Houston's museum of natural science, where she works as director of online media. But it was the work she'd done with the Houston Symphony that I wanted to discuss.

Blatzer led a team of MBA students at the University of Houston that won first place in the fourth annual Google Online Marketing Challenge – the first American team to win. The challenge is open to students from universities throughout the world, and in 2011 attracted 4,429 teams from 68 countries.

The competition focuses on the use of AdWords, a Web product offered by Google for small businesses to help them set up and manage online ad campaigns. Loosely speaking, an online ad campaign consists of money set aside for text ads that are displayed when a Web search is performed with Google. These are paid ads, not the organic (unpaid) search results that Google also delivers. A typical paid ad might appear as follows:

The primary means of payment is based on clicks. If Google displays an ad for a business and a viewer clicks on that ad, Google receives payment. There's no set price. Businesses choose a maximum amount they're willing to pay which is treated as a bid. This means a click will result in payment to Google that may be less than the amount a business is willing to pay, but never more.

Of course, Google is motivated to give all relevant ads good placement because it improves the viewer experience and because only an actual click will result in a payment. But Google also has many competing bidders for the same ad space, and performs sophisticated, proprietary ad placement algorithms designed to maximize Google's long-term revenues.

Yet, while businesses ultimately depend on Google for ad placement, AdWords provides many opportunities for businesses to provide control or assistance to Google on where to place ads. In the control category are items like geographic region. Should a business want to limit views to selected English-speaking cities in Europe, that can be set up. In the assistance category are items such as keywords. When someone uses Google to search for one or more of the keywords a business has chosen, the business's ad may or may not appear, depending on how many other businesses are using the same keywords (and how much those other businesses are willing to pay per click.) In the end, ad placement and, ultimately, the number of clicks a business receives are a complex mix of what the business tells Google, what the business bids for clicks, and how Google evaluates the many different competing ads.

Needless to say, not even Google can explain the placement of any particular ad other than to describe its ad placement algorithms – which, of course, it doesn't do since businesses could take advantage of this information. Google does, however, provide a variety of tools – some quite sophisticated – for businesses to track how their ad campaign is performing.

That's how Blatzer and her team won their award. The first step was to find a good business partner, a requirement for the competition. The Houston Symphony was a fortunate find since it was in the early stages of pursuing online marketing initiatives. As part of that process it was using Google Analytics, another Web product by Google, that could aid the team in designing their ad campaign.

The team was given a $200 credit with AdWords and three weeks to complete their campaign. The decision was made to focus on individual ticket sales since management at the symphony felt this was the best way to reach new customers – customers with the potential to become long-term patrons. After a variety of calculations incorporating items such as expected immediate revenue, customer lifetime value and cannibalization from other channels, a goal of three sales was established since at that point the return would exceed $200.

The team's strategy was to start with fairly tight limits on controls such as customer location and then adjust accordingly. With a limited budget, the idea was to focus attention on individuals with a high perceived likelihood of making a purchase. However, after the first week, the ad had been displayed only 91 times. With only two weeks remaining, it was clear more impressions

were needed to generate sales. Changes were made, and by the end of the three-week period the team had generated more than 13,000 impressions and 10 sales – impressive for a budget of only $200.

The team had to tightly control how it spent its money. They couldn't, for example, bid $10 per click unless they were willing to live with the possibility that the entire budget could be wiped out with as few as 20 clicks. Still, if the bid was too low, the team surmised Google's ad placement algorithms would choose other, more profitable ads to display. What to do?

AdWords requires a business to supply a bid per click that it's willing to pay, but it also allows businesses to place a limit on the total amount of money they're willing to spend. If not, a business might get so many clicks that, unless those clicks generated sufficient sales, it could go broke.

A key insight came when the team reasoned that Google's ad placement algorithms might make decisions not only on the amount bid per click, but on the total amount of money a business was willing to spend. A business willing to pay $10 per click looks good compared to one willing to pay only $1 per click, but the story changes when the first business has a budget of $100 and the second a budget of $100,000. Even though the team had a budget of only $200, they entered a much higher budget – then carefully watched to make certain they didn't overspend their actual budget, thus risking disqualification. If clicks occurred too frequently without generating sales, they could stop the process and reevaluate other aspects of their campaign.

First-place honors included a trip to Google's Googleplex, the company's corporate headquarters in Silicon Valley. There, the winners were treated with the respect due any group that had demonstrated unequaled mastery of the online tools offered by an intellectual and market powerhouse. At a presentation to Google employees, the team probed about the judging criteria. The response was admittedly vague: The team had learned and made adjustments throughout the campaign and the judges were impressed. That was it. Had the judges gone into detail, they were at risk of divulging proprietary information. Understandable for Google, but not much help for future teams entering the competition.

But perhaps the judging criteria weren't really that important. The competition gave students around the world hands-on experience with running an online marketing campaign. Until recently, that's something marketing professors could only dream about. For its part, Google managed to get AdWords into the hands of tens of thousands of students; students who will take their AdWords skills into the workplace and in turn generate ad revenues for Google. And since the student teams were required to partner, the partner organizations were also introduced to AdWords.

For its part, the Houston Symphony earned a $5,000 donation from Google as a result of its involvement in the competition. The symphony also applied for, and received, a credit of $10,000 per month on AdWords as part of the Google Grants program for non-profit organizations. As for Blatzer and her team members, only time will tell. But they're certainly off to a great start.

The team consisted of Erin Blatzer, Lauren Davis, Carolina Thomas and Jeffrei Clifton of the University of Houston under the sponsorship of Professor Steven Koch.

Andrew Boyd *served as executive and chief scientist at an analytics firm for many years and is an adjunct professor at the University of Houston. He can be reached at e.a.boyd@earthlink.net.*

Human rights group confronts abuses with data-driven evidence

Human rights "data" often starts out as a set of narratives that are being captured on the ground in hot spots around the world, primarily by grassroots organizations that live under constant threats from not only weather and natural disasters but also hostile governments and angry armies.

BY VIJAY MEHROTRA

For those who think that the analytics revolution is only about big companies in a few business verticals, the Human Rights Data Analysis Group (http://www.hrdag.org) and its parent organization Benetech (www.benetech.org) just might change your world view. Benetech and its HRDAG initiative are an important, intriguing and instructive success story about analytics and the digital revolution.

I often tell my students that data is the analyst's water supply, so as soon as I heard about HRDAG I immediately asked, "Where does the data come from?" Dr. Megan Price, a HRDAG statistician and analyst, patiently explained that there were some things I first needed to understand about Benetech. Benetech's tagline is, "Technology Serving Humanity," and its goal is to nurture, find and/or integrate seemingly disparate projects that support this mission and help turn them into self-sustaining initiatives.

Human rights "data" often starts out as a set of narratives that are being captured on the ground in hot spots around the world, primarily by grassroots organizations that live under constant threats from not only weather and natural disasters but also hostile governments and angry armies. Launched by Benetech in 2003, the MARTUS initiative (www.martus.org) provides such organizations with software that is used to encrypt, upload and securely store its data on remote servers. This open source software is made freely available for download by the MARTUS team and is used by more than 100 different organizations worldwide. In addition, MARTUS offers Web-based and in-person product demos, technical support and training. Much of the data that HRDAG analyzes comes from the MARTUS platform.

HRDAG began as the brainchild of Dr. Patrick Ball, who has been working on the application of measurement and rational thinking to the field of human rights since 1991. After operating out of the American Academy for the Advancement of Science for several years, HRDAG joined forces with Benetech in 2004. It was a very natural fit, with HRDAG's expertise with statistical modeling, data analysis and human rights experience serving to leverage the descriptive narratives stored through the MARTUS platform.

The process of converting text-based chronicles of human rights abuses into structured databases suitable for statistical analysis is complex, Price explained to me. The HRDAG team begins with the development of a controlled vocabulary that maps to their "Who Did What to Whom" data model, and then training individuals to use this vocabulary when coding the narratives into structured data. This process requires both statistical rigor (including things like inter-rater reliability scales) and legal precision (for example, carefully drawing distinctions between kidnappings and disappearances). Given all of this, the coding process is usually technically and emotionally intense, often bordering on surreal.

Once this has been completed, the data is ready for statistical analysis. To make valid statistical inferences, the HRDAG analysts carefully consider how the data was gathered and work hard to apply appropriate statistical tools. On its many projects around the world (including El Salvador, Chad, Kosovo, India, Liberia, Iran, Cambodia and many other countries), HRDAG's analysts employ a broad array of tools ranging from simple descriptive statistics to sophisticated multiple system estimation methods [1] that allow them to make claims based on data from two or more sources gathered by different groups.

As hard as these statistical problems might be, these are not the most difficult part of what HRDAG does. For HRDAG, speaking truth to power means knowing everything they do will be scrutinized incredibly closely, so every team must intimately understand how the data used in their project was collected, coded and analyzed. There have also been skirmishes with other would-be experts about methods and conclusions [2]. But the most difficult challenge is maintaining objectivity while knowing just how high the stakes and emotions are for the grassroots activists and families who have invested so much and taken such personal risks to record victims' powerful and profound stories.

HRDAG has both limited resources and a sharp focus on conducting analyses that drive policy changes, legal justice, funding outcomes and other tangible outcomes. As such, the decision to engage in any particular project is significantly influenced by the answer to a simple and powerful question: "Does the truth matter?" That is, will the results of a statistical analysis have a chance to make a difference within the context in which the alleged human rights violations have taken place? Sadly, sometimes the answer is "no."

In other cases, after the available data has been analyzed, the results of the analysis simply may not be able to support the allegations of systemic abuse, a challenge that Ball discussed quite candidly in a recent presentation [3]. Indeed, there may be no better evidence of Ball's commitment to the truth than his willingness to openly and honestly acknowledge such imperfections in past practices.

Twenty years in, HRDAG has emerged as a classical high-performing analytics organization. As advances in technology have enabled improved data quality and availability, HRDAG has successfully developed and deployed appropriate analysis techniques to address complex questions. Its leaders carefully select projects based on the potential for significant impact, and they have developed a culture of carefully examining every step in their information value chain, standing firmly behind what they have learned and acknowledging the limits of what is knowable from the available data.

There is no way for us to know how much of their success is due to Gretzkian creativity ("I skate to where the puck is going to be, not where it has been") and how much is due to Goethe-inspired commitment ("The moment one definitely commits oneself, then providence moves too"). But certainly the world is a better place for having HRDAG and Benetech in it.

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1. These techniques were originally developed for use with fisheries and wildlife populations, and were later adapted for a wide variety of other applications. For more, see "Capture-Recapture and Multiple-Record Systems Estimation I: History and Theoretical Development," 1995, *American Journal of Epidemiology,* Vol. 142, No. 10, pp. 1,047-1,058.

2. See for example www.hrdag.org/resources/publications/Co-union-violence-paper-response.pdf.

3. For more information about this presentation, see www.forbes.com/sites/mahaatal/2011/02/17/patrick-ball-on-the-perils-of-misusing-human-rights-data/.

The value of business analytics

Most organizations have a relatively immature understanding of what "business analytics" is, let alone how it creates value.

BY EVAN STUBBS

The intersection of statistically based insight and the realization that information can be an asset has had and will continue to have serious reverberations in the business world. Being smarter has always meant being successful; as far back as the 19th century, analytics was already generating competitive advantage.

Success requires more than just knowledge of statistics or ways of dealing with "big data." Execution is essential, but without a plan and commitment, little happens. Success also requires an understanding of how analytics translates to competitive advantage.

Possibly the best-guarded secret in business analytics is that, in practice, its success comes down not only to organizational culture but also to the ability of managers to successfully sell the value of analytics. As researchers such as Thomas Davenport and Jeanne Harris have rightly pointed out, overall success can often be linked to a variety of factors including organizational structure, management commitment and successful strategic planning. However, it's often "where the rubber hits the road" that the greatest impact can occur.

Analytics is a multi-disciplinary activity: the value from insight comes not from the activity but from the execution. Often, this crosses a variety of departments within an organization – few analytics groups have responsibility for both the insight creation and the execution of that insight. Because of this, selling the value of analytics isn't just a goal for managers; it's a necessary criterion for success.

For many managers, this can be challenging. Despite broad interest in business analytics as a discipline, most organizations have a relatively immature understanding of what "business analytics" is, let alone how it creates value. When projects fail, it's all too easy to point to the organization as the reason why success

wasn't achieved. Unfortunately, this is only half the picture – the harsh reality is that we, as managers and analysts, all too often carry a large portion of the blame. In an ongoing straw poll held by the author across more than 1,500 people, only a handful ever feel that they could quantify the value they were creating through applying business analytics. When even the experts can't explain why analytics is important to the organization, what hope does a layperson have?

The value of analytics lies in its ability to deliver better outcomes. And, when it comes to selling the value of business analytics, four mistakes stand out above all others as the biggest blockers of success.

▶ ***Mistake No. 1:*** *If you can't define the value, how do you know what it's worth?*

Picture this: You're the person who controls the purse strings for your company. In front of you is a long list of investment opportunities, all of which have very logical and persuasive reasoning behind why they're important. Unfortunately, you only have so much money and resources to allocate. So, how do you prioritize?

Usually, it involves looking at the ratio of economic return to investment, as well as who's supporting the initiative. Unfortunately, far too often business analytics champions fail to capitalize on these as effectively as they might. Instead, they try to gain funding through little more than smart ideas and good intentions.

This lack of value definition may seem paradoxical given the advanced mathematical abilities of most teams – after all, these are the teams that more often than not have the best modeling abilities in the entire organization! Typically though, it's simple oversight combined with a lack of financial domain knowledge that leads to this pitfall. While it's a given that business analytics has the capacity to create value, it's hard to convince everyone else of that fact without being able to define this value. And, it's often after the fact that the team realizes how important this value definition really is.

Return can be viewed from a variety of different perspectives. Sometimes, the time needed for an investment to pay for itself is the most critical measure. At other times, the leverage created from an investment is the most important measure.

▶ ***The Solution:*** *Make sure you define the value.*

Business analytics creates value. However, the only way to communicate that value is to quantify it. Defining the value needn't be a complex process. Some of the most important things to consider include:

- Identifying the right measures of return
- Profiling both tangible and intangible return
- Considering a range of benefits

Return can be viewed from a variety of different perspectives. Sometimes, the time needed for an investment to pay for itself is the most critical measure. At other times, the leverage created from an investment is the most important measure. Irrespective of what the appropriate measures are, every business analytics initiative should generate returns in some form, regardless of whether those returns come from cost efficiencies, margin improvements or sheer revenue growth. Capturing and defining these returns in an appropriate manner is often a prerequisite to even being considered for funding.

Profiling both tangible and intangible returns is also important. While investment decisions often require that the project create economic returns, political support often comes from the intangible returns of a given project. Simplifying process complexity in itself may not provide enough cost reduction to justify investment. However, if it helps the process owner get home in time for dinner two nights a week, their support is almost guaranteed. Given the importance of cross-departmental teams in most business analytics projects, the leverage this support can provide can't be understated.

Finally, good business analytics initiatives typically deliver a number of benefits. One of the biggest advantages of business analytics comes from the ability of an organization to re-apply existing competencies across multiple business problems. Modeling skills can be applied to support improved customer retention, increased revenue through cross-sell and improved returns through better debt collection. A well-designed business case identifies each of these, recognizing business analytics as the broader growth driver it is.

▶ ***Mistake No. 2:*** *If people can't understand the value, why should they care?*

It's fairly obvious that we prefer things we can understand. Unfortunately, it's easy to forget that everyone views things differently. While our perspective may be the most familiar, it may not be the same as the one held by the person we're talking to. All too often analysts will get caught up in the technical detail, explaining the intricacies of one algorithm over another when all their audience is interested in is, "What's the benefit?"

Communication breakdowns can be one of the most frustrating things in any business analytics project. A typical project cuts across multiple groups within the business, often spanning IT, the analytics team and the operational execution team. It's almost inevitable that miscommunications will occur. If these aren't recognized and planned for, it's usually the project (and the analyst's sanity) that suffers.

▶ ***The Solution:*** *Make sure you communicate the value.*

The best business analytics champions are more than just domain experts; they're also evangelists. A key skill in their kitbag is their ability to understand their audience and tailor their message to suit. Making sure their message is relevant is a critical first step. Equally as important is recognizing that people view things differently and that an effective communication strategy requires working to different perspectives.

Four of the most common perspectives are:

- The analytical perspective
- The process perspective
- The personal perspective
- The strategic perspective

Most analysts are familiar with the analytical perspective. Usually, it focuses on how the initiative will work, often describing the quantitative value that will be created. It's the most evaluative approach and normally revolves around establishing logical relationships and applying rational persuasion. For champions interested in communicating in this way, it's often useful to use formal presentations and other structured methods.

The process perspective usually focuses on what needs to be executed. It tends to emphasize the steps that will be taken, the governance that will be needed and the responsibilities that will go along with the new approach. Quality, execution time and the implied change are often of key interest. Much like the analytical perspective, champions interested in communicating this way often leverage formal presentations and other structured methods.

The personal perspective focuses on how the initiative will impact individuals within the organization. Of key interest is often how the initiative will make people better off, regardless of whether it's through personal or professional benefit. Intangible value is usually emphasized along with how existing teams will extend their responsibilities. Champions interested in communicating this way often prefer more informal methods.

The strategic perspective focuses on the holistic impact of the initiative. It's the most "big-picture" approach, usually focusing on competencies, competitive advantage, and overall systems. Often, a key focus is on how the initiative will make the organization better off supported by evidence of best-practice, linkages to strategic objectives and reference to market influences. Champions interested in communicating this way often prefer a highly interactive approach, usually involving white-boards and open conversation.

In addition to evangelism, effective business analytics champions avoid the pitfalls of miscommunication by weaving these different perspectives into a holistic communication strategy, tailoring it to suit their audience. By communicating the value of business analytics in a way their audience can relate to, they gain traction and build support. Business analytics isn't about statistics; it's about delivering organizational change.

▶ ***Mistake No. 3:*** *If you don't know where you're going, how are you going to get there?*

Business analytics is a double-edged sword. On one hand, it has almost unlimited potential for re-use across multiple business problems. On the other, there's so much it can do that it's easy to take on more than can ever be delivered. Achieving the balance between meeting strategic goals and delivering tactical returns is challenging. Too much of one and the team runs the risk of being perceived as a group that's always "almost there." Too much of the other and the team runs the risk of being seen as a fire-fighting unit that's never in charge of their own destiny.

Few teams effectively link their tactical activity to larger growth opportunities. This often leads them down a path of operational firefighting and constrained investment, often because they can't

demonstrate a clearly defined growth path. If left unchecked, the team eventually suffers rising rates of churn because of general frustration and a heavily constrained budget.

▶ ***The Solution:*** *Make sure you deliver the value.*

For a business analytics team, the pinnacle of success comes from not only delivering real economic value but also creating and leveraging sustainable competitive advantage. Key to this is understanding how tactical activity maps into strategic outcomes. Increasing the odds of success is relatively simple. For many teams, it involves:

- Establishing direction through creating a roadmap
- Freeing resources through leveraging tactical revolutions

For many teams, the end-goal is the creation of a sustainable competitive advantage for their organization. Common examples include the ability to respond to market conditions faster than their competitors or achieving the highest level of customer satisfaction through one-to-one engagement. Effective use of business analytics helps the organization create a differentiated approach, one that's often hard to replicate. However, these competitive advantages must be nurtured; if they were easy, they wouldn't be a sustainable competitive advantage.

Few organizations, however, can afford to have their analytics team spending a number of years working on creating this advantage without any immediate economic return! For many teams, success comes from understanding the interdependencies between enabling initiatives and growth initiatives, as well as how these map into competitive advantage in the longer-term. Ideally, these are then mapped into a roadmap that balances short-term value creation with longer-term competitive advantage.

While the roadmap is critical in defining direction, most established teams struggle to get investment based on their roadmap. Usually, their growth needs to be organic with incremental investment based on historical returns, not future. Normally, the key challenge for these teams is figuring out how to do more work without any additional investment; without demonstrated returns, they can't get more funding. However, the perception is often that without additional funding, they don't have sufficient resource to generate greater returns!

One approach that can successfully overcome this Catch-22 is through

Measures are only useful if they can be captured. That may seem obvious, but it still remains surprising the number of times teams establish outcomes which, despite being intellectually attractive, fail to have the underlying systems necessary for their capture.

leveraging incremental efficiency improvements to improve productivity. In sufficient number, these productivity improvements can be re-invested in growth initiatives, delivering economic returns and justifying further investment. Often, these improvements stem from more effective data management processes, streamlined model development or improved operational deployment of models.

These tactical revolutions help the team free up enough resources to start creating incremental economic returns. And, the roadmap helps create a tangible vision of their transformation. Together, they help many teams deliver value.

▶ ***Mistake No. 4:*** *If you can't prove what you've delivered, why should people trust you again?*

It's one thing to deliver; it's another to demonstrate to others that you've succeeded. Even teams that successfully achieve their outcomes run the risk of perceived failure if they can't convincingly demonstrate their success to their detractors.

▶ ***The Solution:*** *Make sure you measure the value.*

Measuring the value needn't be complex – in practice, the best measurement frameworks tend to be the simplest. At a minimum, however, they need to:

- Be able to be captured
- Minimize the overhead imposed on the team
- Be comparable across projects

Measures are only useful if they can be captured. That may seem obvious, but it still remains surprising the number of times teams establish outcomes which, despite being intellectually attractive, fail to have the underlying systems necessary for their capture. A classic example is trying to measure reductions in customer churn rates due to analytically based targeting. While this seems straightforward, it's often the case that operational customer-relationship-management systems lack the ability to capture whether or not a recommended offer was made by contact center staff. In the absence of this, it's impossible to know whether poor results are due to the targeting being used or simply because contact center operators neglected to make the offering the first place!

Equally, some of the worst measurement frameworks are the most comprehensive. During the design phase, it's often highly attractive to build as many measures as possible into the reporting layer. Unfortunately, unless these measures are transparently and automatically created by the underlying systems, every additional measure that requires manual input by definition reduces the time spent on actual value-creating activities. At best, the heaviest frameworks are simply ignored. At worst, they actually reduce productivity.

Finally, these measures must be comparable across projects and initiatives. The biggest value of a measurement framework lies in its ability to benchmark highly varied initiatives. Without this ability to benchmark initiatives and activities, the measures captured are meaningless.

An effective measurement framework covers a good selection of business, analytical and technical measures. Business measures help demonstrate the value that's been achieved, not the effort that's been needed to get there. Analytical measures help focus attention where it's needed by measuring the quality of analytical assets. And, technical measures help optimize by measuring the effort and time needed to achieve outcomes. Taken together, these help analytics professionals demonstrate their value-creation to the rest of the organization, prioritize their effort and investment, as well as identify potential sources for future optimization.

THE POWER OF INFORMATION

Competitive advantage comes from capitalizing on uniqueness. Every organization is different and every organization has the potential to exploit that exact uniqueness in a way that no one else can match. Doing this means taking advantage of their single biggest resource: their data.

This tsunami of information is a real challenge at every level in society. At a personal level, we struggle to keep on top of everything that's happening around us. Alvin Toffler coined the term "future shock" as early as 1970 to describe the overwhelming and disorienting impact from information overload. And, at a professional level, where we once struggled with a paucity of information, we now struggle to pick which pieces of information are important out of the millions of measures at our fingertips. Regardless of where you start, this ever-increasing amount of information has changed the way we view the world, the way we live and the way we do business.

Dealing with this data deluge requires being smarter. It requires developing the ability to selectively process information based on value, not sequence. It requires, more than anything else, the realization that brute force and manual effort are, in the long run, an impossible solution. Quite simply, it requires the effective application of analytics.

The people who know how to manage this data deluge are our future. Being able to translate massive amounts of data into real insight is beyond magic – it's competitive advantage distilled. Nothing else offers an equivalent level of agility, productivity improvement or renewable value. Being "smarter" than your competitors isn't just hyperbole, it's a real description of how significant the impact of applied analytics can be.

Armed with the ability to quantify, communicate, deliver and measure the value they create, these modern day magicians understand that statistical expertise alone is not enough. Instead they become change agents, transforming the organization around them. ▮

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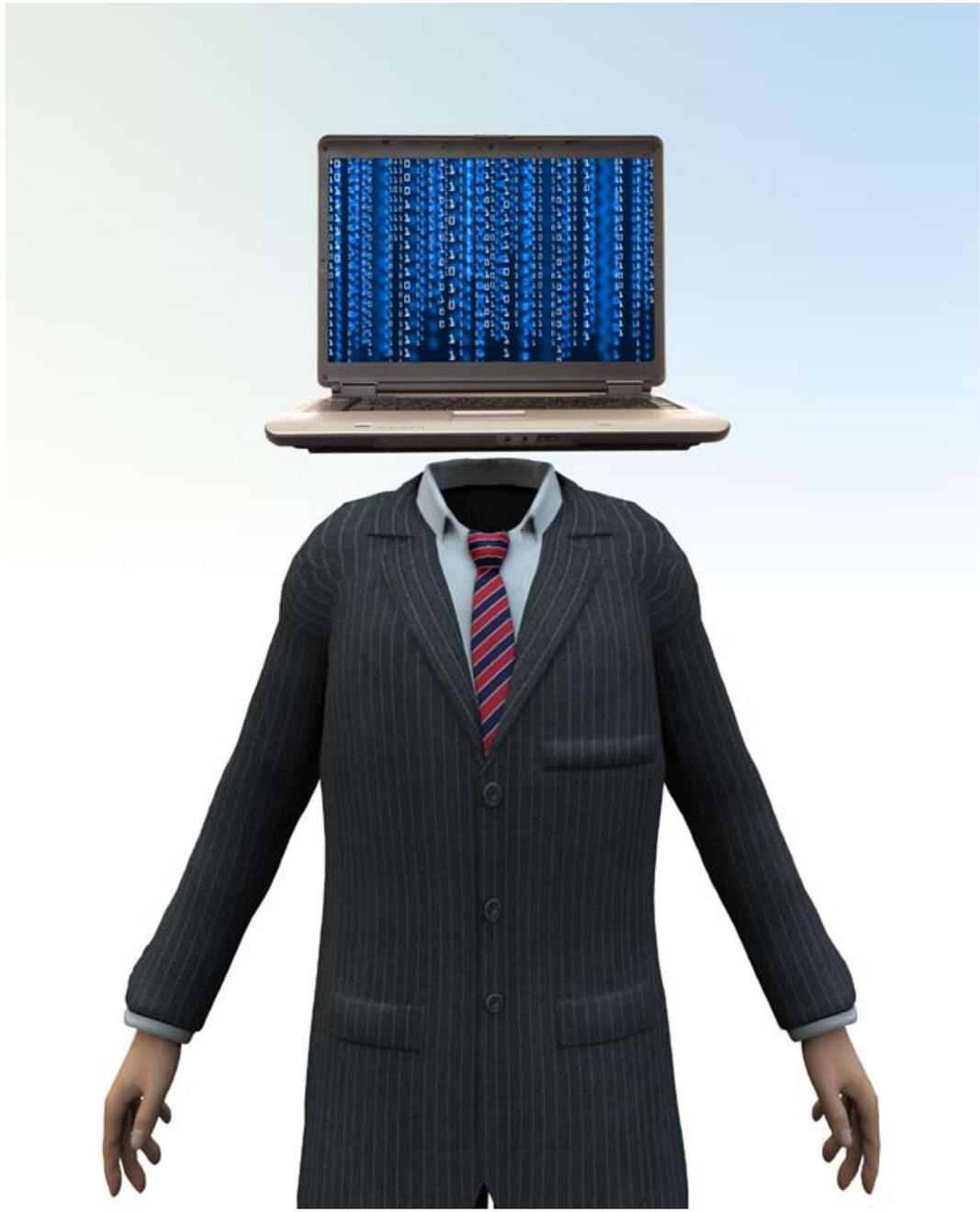
Intelligent augmentation

Making better, just-in-time decisions by combining human and computer intelligence.


BY RUSS VANE (LEFT) AND DOUG SAMUELSON (RIGHT)

Decision-makers do not lack information, although they often complain that they lack the information they need. We are awash in data and have increasing trouble making sense of it. Artificial intelligence (AI) has been promising to help us for four decades. Computers are fast at processing large amounts of relevant data following human-developed rules, but they struggle to turn data into information and information into evidence that makes sense of our situation. What we need is intelligent augmentation (IA), combining humans and computers to make sense of what data we have by using the strengths of each.

As Karla Hoffman of George Mason University said in 1999, “Successful O.R. processes are being translated into software.” In this succinct statement she summarized how hard it is to sell better thinking alone or even better processes. This statement is even truer today with



To forage effectively for data, one benefits by knowing in advance what one seeks to find. Thus, sense-making must precede information collection, as otherwise the searcher tends to fail both by collecting too much and by searching too much.

the proliferation of small, personal computing devices.

To forage effectively for data, one benefits by knowing in advance what one seeks to find. Thus, sense-making must precede information collection, as otherwise the searcher tends to fail both by collecting too much and by searching too much. Because of this, simply gathering vast quantities of data is unpromising: exabyte repositories look like a dead-end technology. Instead, we recommend trading knowledge for search by setting up a filter that watches information pipes (or streams, as IBM calls them). This way the computer's filtering and scanning keeps the decision-maker up-to-date with which of numerous proposed courses of action is most promising, in real time.

Furthermore, this is exactly the kind of technology that rewards a number of startup companies in significant, financial ways. Smart and wise people will be able to deliver niche applications for the financial, military and medical communities that pay for themselves in months, not years. Even the venture capitalists would benefit from having better models for how to assess investments – but models that extend the humans' expertise rather than trying to replace it.

We present a simple model of sense-making, foraging and stewardship that will help us make rapid advances and engender substantial improvements in business decision-making.

WHY IA MEANS BETTER BUSINESS

Some companies fire customers. Why? The short story is that such companies assess that the relationship is Win-Lose and that they are losing. A more comprehensive way to ask the question is: What higher-level patterns are operative, or is this decision actually a mistake wrapped in self-justification? When done right, such a decision is more than that, a lot more. The situation must indicate that there are more customers available, and that the companies feel that they have a quality advantage. And that this option, however negative, is actually better than other options. Such assessments involve a lot of thinking and some pertinent information.

We must assess the quality of the relationship. In order to specify any improvement over things as they are, we must be able to envision something better, which is based on knowledge. From that we understand normal, exceptional or poor performance. We frequently even know explicit contexts where we suspend our standard assessments and invoke extraordinary ones.

The key factor in effective IA will be ***the decision-maker's (your) genius.*** No one else is likely to have the same ideas or beliefs. So IAs are designed to make you better and to do the accounting cleanup. Your experience and relationships are precisely what you and your colleagues will use to provide the edge to your next business venture.

Furthermore, being able to wait to execute a decision is often an advantage because it denies competitors from knowing your decisions and puts them under time pressure to respond.

QUANTIFIED REQUIREMENTS FOR IA ENTREPRENEURS

A decent metaphor for great IA is that of a *well-connected and wise confidante.* Computers and software are not wise, but they may be programmed to emulate wise well enough, and that's what people will choose. To help specify and guide such projects, we start with two essential elements: quality and quantity.

A helpful first step is to identify the benefits desired from a product and then identify the qualities needed to engineer it well. Performance, trustworthiness, understandability and capacity-to-improve are all qualities of useful good employees and effective intelligent augmentation (IA).

Lord Kelvin [1883] said, "I often say that when you can measure what you are

speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind…" Tom Gilb has written numerous articles and some books [1988, 2005] on practical ways to quantify quality, introducing and explaining the concept of quantified requirements (QRs). We believe this is an important first step to improving anything, but particularly IA.

We will use four qualities as an example of QRs; the reader may think of some that are better. We welcome comments.

First, as specified by Gilb, QRs have two levels of performance of interest: the "must" and "target" criteria. A "must" criterion is the ***least benefit*** that may be provided by a solution to continue spending money on developing a product. For example, IA may not decrease the performance and value of its user's decisions. A "target" criterion is the ***most benefit*** for which the product's client will pay. For example, the client will not pay for any voice recognition software that ingests more than 500 words per minute. We can therefore think of the relevant range for this requirement as a 100-point scale, with "must" at 0 and "target" at 100. Together, these criteria prevent waste and guide designs by encouraging deliveries of products that deliver as much value as possible in each version of the product.

QRs can also help to see how much knowledge the design staff has. IA developers are encouraged to consider multiple solutions and to rate them by the QRs for their project and to make a rough cost estimate. An Impact Estimation Table (see figure 1) allows the CEO/CIO to select the preferred approach during the next in-progress review, based on his/her judgment about the future. Sometimes that may be financially driven, but often it is based on quality gaps in the current version of an IA project.

QR	As Currently Tested*	Design A	Design B	Design C
Capacity-to-Learn (user customizing)	10	100	80	80
Trustworthiness	10	100	100	80
Understandability	10	100	80	80
Performance	200*	100	100	80
Total Costs	$200K	$2.0M	$1.5M	$.4M

Figure 1: Impact estimation table.
**The system is very fast, but will slow down as the system gains capabilities.*

The impact estimation table in Figure 1 shows the four notional QRs are Capacity-to-Learn, Trustworthiness, Understandability and Performance. These are listed in the left-most column; the next column is always the test results of what has been delivered to-date. Any other columns are designs that may guide future development. Design A is the project as specified. Designs B and C are less costly or just simpler to build.

Capacity-to-Learn (sense-making from knowledge) – The flexibility of informational models that can record knowledge that can be "taught" by the user. *Must* is that we are able to model 20 percent of our beliefs about normal. *Target* is that we are able to model 60 percent of our beliefs about normal and extraordinary.

Trustworthiness (foraging for trusted information) – The degree to which people will agree to: "You are rarely surprised by sloppy information vetting." *Must* is that three of five reviewers (using a five-point Likert scale) rate the model from 4 to 5 (Agree to Strongly Agree). *Target* is that four of five reviewers rate the model as a "strongly agree" to the same question.

Understandability (stewardship of IA users) – The amount of time in seconds that [a fraction] of users require to understand the information presented. *Must* is that 80 percent of users understand in less than 2 minutes. *Target* is that 98 percent of users understand in less than 5 seconds.

Performance – The inference lag associated with data ingest of 54 Mbps in seconds. *Must* is that 4 of 5 users are likely to be current to within ten minutes. *Target* is that 98 percent of users are likely to be current to within three minutes.

These QRs can be used to drive sense-making, foraging for information and support stewardship of users of IA. More qualities can be used to specify an exceptional product, but these serve as examples.

HOW TO USE YOUR IA

We now turn to some ideas on the natural flow of user guidance to the IA to perform tailored sense-making, its sensing/foraging mode, and its presentation of information to (or stewardship of) the user.

A Northern Virginia entrepreneur and ex-Air Force fighter pilot, Arthur Farrington says, "Nothing is anything until you make it something." As information scientists have explored the boundaries between information and knowledge, "knowledge" captured in a machine has remained elusive. The authors' premise is that humans are important for any system to have knowledge. In one example, recent trends in the last several years in U.S. intelligence community research have been stressing sense-making as a preparatory step.

Psychologists have acknowledged difficulties with sensing almost anything that humans don't understand. Frequently, such sensing (a house sound, a dog bark, etc.) is assigned to random forces. This is

even truer of computers – just think of the great usability divide between structured and unstructured data. Consider how we address these issues. To the alert or paranoid human, these sounds may be cause for immediate action.

Information is not knowledge, and sense-making requires exploring the information's valid and erroneous contexts and protecting the user from misuse. Even more so, we need to be able to snap into place inhibitory circuits to interrupt processing when the reasoning is overcome by events.

To bootstrap early IA devices we will probably require specifying knowledge emulation modes – mathematical, typological, linguistic – in ways that have not been invented. But knowledge elicitation has been refined with significant advances during the last 10 years through the application of wargaming techniques [Herman 2009] and hypergame theory [Vane 2001].

Or you may just want to adopt the favorite IA applications of a colleague, mentor or boss.

FORAGING FOR INFORMATION

We do not recommend looking for data first, and that is why this aspect appears second. Each person's perception of our shared universe is often very different, so even the data that we will accept as evidence is different. This observation should suggest that most of us will need tailored foraging approaches.

The factory model for information collection isn't quite dead, yet. But it will ***not*** be the consumer data of the future. In fact, it's unlikely to be data at all, but information that is moving up the context ladder towards immediate contextually sensitive relevant information about those aspects of life that we value.

And we'll need a way to compare them to address conflict. Deductive "accounting" for data sources, assessments of verity and source verification is absolutely boring. It is not mindless, however, and requires effort. Arguments that devolve away from good faith negotiations are observed too frequently.

STEWARDSHIP OF IA USERS

IA raises new issues as it promises to resolve current problems. As processors decrease in power consumption and increase in speed, are we headed toward a technically supported elite segment of society that establishes its preeminence by the information that it has? Are we already there? What is the effect of cloud computing; does it make vast computing power available to many at the cost of making most people's information increasingly vulnerable to the actions of a few?

People communicate using information – symbols – not mind-to-mind transfers. And computing networks increase the speed of transfer of information. But we need better. Speed is not the only consideration.

Examples abound, usually under the guise of visualization. But visualization is about communicating to the eyes – not the mind. We need processing oriented to creating and maintaining a theory of mind – just like humans do – to best serve IA users. For example, analysts often tailor the information for presentation to military people in geospatial form, as these decision-makers' learned senses of power, space, and timing allows them to understand much more, such as probability of success, supply rates and morale of combatants. What counts is not volume but verisimilitude. We can show less, but keep it "real" and communicate more.

For biologists/chemists/physicists, it may be virtual experiments, such as those

described by Dr. John Bodnar of Stevenson University [2009], who points out that modeling far beyond thought experiments of the 1910s will help the scientific community to shed broken, too simple models of biology (and even space-time). It's too hard to apply more than a few ideas at the same time. But IAs can support such reasoning and require the models obey entropy, enthalpy, photon energy transfer and other physical laws that we frequently only rediscover by conducting actual experiments at costs that are more than one thousand times more expensive.

For instance, any of the electronic book systems can support many features that make using a Bible better: search, multiple versions, embedded notes and so on. But a theologian friend is even better. She remembers Scripture as you discuss it and advances (or challenges) your theses with relevant, helpful information that serves to construct your conclusions. So should IA.

In 2050, the question won't be, "Are you using intelligent augmentation?" but whether you are using the latest model from the three companies who will be vying for supremacy in the consolidating sector. As we foresee it, in 2020 there will be 30 and in 2030 there will be at least 100. Analysts will do well to advance IA and become facile with it, and decision-makers will do well to learn how to use it and benefit from it. ▮

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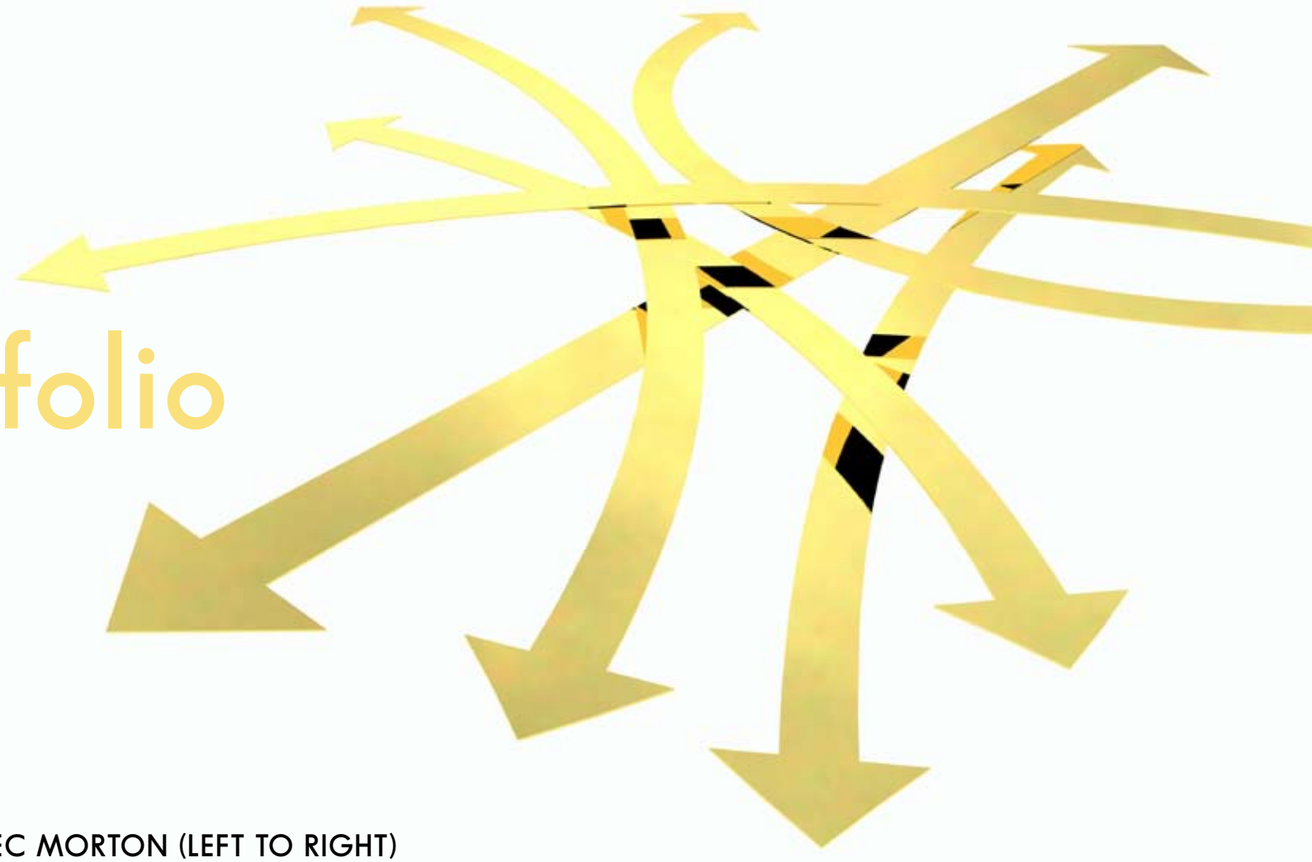
Improving resource allocation with portfolio decision analysis





BY AHTI SALO, JEFFREY KEISLER AND ALEC MORTON (LEFT TO RIGHT)

Practically all organizations achieve their objectives by building a portfolio of activities subject to budgetary and other relevant constraints. Industrial firms, for example, allocate resources to research and development projects (R&D), expecting that these projects lead to profit-generating products. Municipalities commit funds to initiatives that offer social and educational services to citizens. Regulatory agencies impose controls to counter threats to human safety and environment. Even individual decisions can be viewed analogously. For instance, students must decide which courses and recreational activities to take on, realizing that time is a limited resource when seeking to complete one's studies successfully and on schedule while still having a rewarding social life.

Despite their differences, these decision problems share similarities. They all involve decision-makers faced with alternative courses of action, which, if selected, consume resources and lead to consequences with regard to multiple criteria. The actions are typically interdependent, if only because they compete for resources from the same resource pool. They may have direct interactions, too, as in the case of synergistic R&D projects. Uncertainties, too, can be important, because it may not be known ahead of time what consequences the actions will lead to or how much resources they will consume. And apart from the technical aspects of decision modeling, the social and political aspects of the decision process can be central, particularly when addressing strategic questions where the decision-makers need to develop an improved shared understanding of and a joint commitment to the appropriate way forward.

PORTFOLIO DECISION ANALYSIS

In response to these challenges, decision analysts have developed approaches that bring greater rationality and transparency to resource allocation ([1] Kleinmuntz, 2007). These approaches – which we call "portfolio decision analysis" or PDA for short – are employed extensively in most

industries and many areas of public decision-making, yet PDA has not attracted comparable attention in the operations research literature. This realization was one of our motivations for editing the book "Portfolio Decision Analysis – Improved Methods for Resources Allocation," which has just been published by Springer [4]. Written by leading researchers and consultants, the 15 chapters in the book present theoretical and methodological advances. They also illustrate how different problems can be approached with PDA.

In contrast to "conventional" decision analyses, a distinctive feature of PDA is that it explicitly recognizes interdependencies among the alternatives. This is not the case, for example, if decisions are taken a one-on-one basis by checking whether or not the alternatives exceed a pre-defined hurdle rate. By design, PDA recommendations are therefore based on a more comprehensive problem representation where resource constraints bear equally to all alternatives. Also, the portfolio approach ensures that decisions are taken following a well-structured process, based on a comparable set of information about each of the alternatives. Such a process improves the quality of decision-making because it ensures that all alternatives are treated similarly. For example, it eliminates the risk that some unattractive alternative would be chosen merely because it was fortunate enough to have been evaluated at the beginning of the financial year when the budget was not yet depleted.

APPLYING PDA

PDA methods can be applied through a series of logical steps, proceeding from: (i) structuring the problem by clarifying what the decision objectives are and how important they are, to (ii) identifying what alternative courses of action will be analyzed together as a portfolio, to (iii) assessing what impacts these alternatives have on the objectives, to (iv) specifying what resource and other constraints must hold in portfolio choice. Depending on the problem, characterizing the interdependencies between the alternatives or characterizing the key uncertainties around costs or impacts may be necessary. Finally, synthesizing all these inputs within a PDA framework gives insights into which portfolios are "good" choices (i.e., non-dominated, meaning that no other portfolio is least as good on all criteria and strictly better on some), and what alternatives are contained in these non-dominated portfolios.

Taking an example from the pharmaceutical sector – where PDA methods are

used extensively and whose portfolio management practices are covered by Jack Kloeber in our book – the alternatives can be R&D projects in different clinical phases in the product development pipeline, the constraints are implied by limited budgets and the availability of human resources, and the objective is to maximize the profitability of the product portfolio that builds on R&D. In this decision problem, PDA methods show which portfolios are likely to generate most profits and, moreover, which projects should be selected, subject to relevant constraints and the recognition of possible project interdependencies.

A key question in PDA is what alternatives should be treated as being part of the "same" portfolio. Expanding the set of alternatives may lead to more comprehensive (and hence "better") solutions. Yet expanding the problem scope in terms of its planning horizons, amount of resources, span of organizational unit or number of participating stakeholders may lead to difficulties. For instance, more time may be needed to assess the impacts alternatives; these assessments may be less accurate due to longer planning horizons and management may not be able to get a good intuitive grasp of portfolios that contain hundreds of alternatives. Furthermore, it can be difficult to "operationalize" criteria that can be applied to alternatives that are very different from each other. For example, while the efficiency of fuel cars can usually be measured by fuel consumption, it is not immediately clear what a suitable shared metric would be for measuring the efficiency of a large pool of vehicles consisting of fuel cars, hybrid cars, motorcycles and electric buses. Thus, instead of seeking to determine a global "optimal" portfolio, it may be better to define multiple, possibly interlinked portfolio problems, for instance by making use of formal problem structuring methods discussed by Gilberto Montibeller and L. Alberto Franco in our book.

From the viewpoint of accountability, a benefit of a systematic PDA process is that it leaves an explicit track record that can be used later on. This track record can be used for justifying and communicating why the decisions were taken the way they were or for explaining what the likely results would have been, had a different portfolio been selected. The track record can also be sued for purposes of organizational learning, because organizations may work more efficiently if they adhere to a similar process design across departments and sections. These kinds of process benefits can be important particularly in public decision-making where the decision process is often subjected to at least as much scrutiny as the decision itself.

USING TOOLS AND SOFTWARE

PDA problems are computationally challenging: Even if the available set of alternatives is small, the number of different portfolios can be staggering. For instance, in the seemingly simple problem where five projects are to be selected from a set of 20 project proposals, 15,504 different portfolios can be considered. Although the large majority of these portfolios are uninteresting – in the sense that they are dominated by some other portfolio – the large number of possible portfolios makes it imperative to apply appropriate methodological and computational tools.

Thanks to active efforts in this area, several software tools now help identify all non-dominated portfolios a rational decision-maker would be interested in ([3] Lourenço et al., 2008). Some of these tools – such as RPM-Decisions, which is based on Robust Portfolio Modeling 9RPM ([2]Liesiö et al., 2007) – admit incomplete information about the alternatives and the relative importance of evaluation criteria. Based on this information, they identify "core" alternatives that belong to all non-dominated portfolios. These core projects can be recommended to the decision-maker, because they would belong to the optimal portfolio, even if one were to obtain more information about the alternatives or the decision-makers' preferences. Thus, the possibility to work with incomplete information means that PDA methods can be usefully applied before all the alternatives have been thoroughly evaluated in order to give decision recommendations based on information that is already available or which can be generated with a reasonable effort. The value of RPM-Decisions and similar tools has been demonstrated convincingly in numerous case studies. One of these is presented by Antti Toppila, Juuso Liesiö and Ahti Salo who report a successful application of RPM to technology management at a major telecommunication company.

Numerous methods exist that can be employed to support portfolio decisions. This leads to the question of what methods are "good" or perhaps even "better" than others. There is no definitive answer to this question, because the "goodness" of a given method in a given problem depends upon how adequately this method is able to capture the salient problem characteristics and how responsibly it is deployed to inform decision-making. Having said this, we believe that a strong case can be made for approaches that build on the logical foundations of decision theory, most notably in the spirit of multi-attribute value theory and multi-attribute utility

Let there be a budget of $40 Million and assume that at most two projects are to be selected based on NPV and strategic merit, in the absence of information about how important these two criteria are relative to each other.

Project #	Cost (M€)	NPV (M$)	Strategic merit (1-7)	Core Index
1	20	45	4.9	1
2	30	50	1.5	0
3	10	24	4.6	0.5
4	5	10	3.1	0
5	15	43	3.4	0.5

The Core Index is the share of all non-dominated portfolios in which a project is included.

Table 1

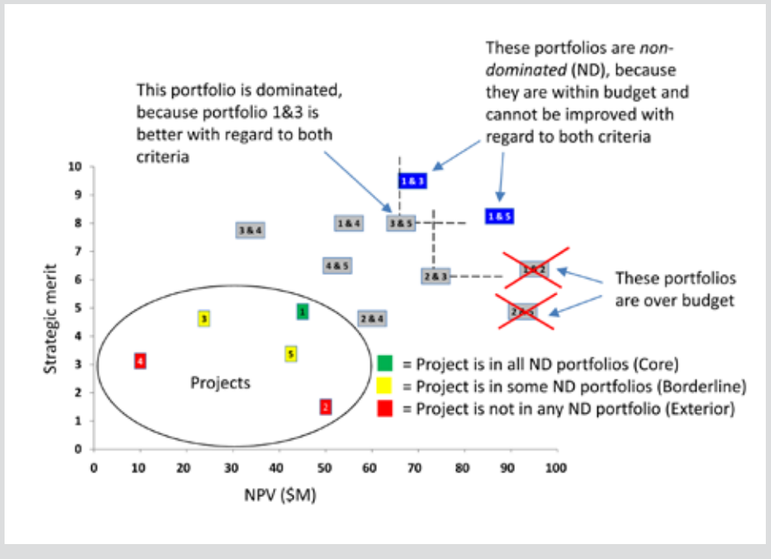


Figure 1

Decision recommendations:
Core – a certain recommendations to select into the portfolio
Exterior – a certain recomendation to exclude from the portfolio
Borderline – no recommendation of either excluding or including into the portfolio

theory which both have solid axiomatic foundations.

CONCLUSIONS

Many promising avenues exist for further research and applied work in PDA. On one hand, recent advances in PDA methods and tools provide tested but not yet widely adopted approaches for improving the quality of decision-making. This suggests that organizations can reap significant benefits by revisiting their current practices and replacing these by "state-of-the-art" approaches where appropriate. On the other hand, decision processes themselves need to evolve under many pressures. For instance, there is a need to: account for a growing range of incremental and disruptive uncertainties; to understand what portfolios perform acceptably even in the less desirable scenarios; to bring in knowledge from an even greater number of experts; to exploit technologies for social networking in portfolio decision-making; and to build capacities for reaching well-founded decisions more quickly. These and yet other challenges suggest new topics for research, too, leading us to believe that PDA will become an increasingly vibrant area of decision analysis and operations research at large.

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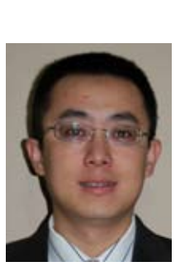
Analytics applications in consumer credit and retail marketing

Four areas that present a significant opportunity to impact the bottom-line of companies in different business verticals through the use of advanced analytics and sophisticated data modeling.


BY MING ZHANG, CLAY DUAN AND ARUN MUTHUPALANIAPPAN (LEFT TO RIGHT)

The application of analytics in financial services is advanced and pervasive; the use of credit risk scoring techniques permeates the entire customer lifecycle management – from credit grant to account management to loss reduction and recovery. Without automated credit scoring techniques, the large-scale, modern day consumer credit industry as we know it would not exist. By comparison, analytics in consumer retail marketing is still relatively undeveloped. Except in the area of direct marketing, where consumer response-based targeting models are widely used and well accepted, analytics applications in other areas of the business is less systematic and varies widely across companies and sophistication of executives in charge of marketing. This article briefly reviews the successful evolution of analytics in the consumer credit business, while exploring four areas in consumer retail marketing that are not as well developed but hold great potential for substantial business impact.

APPLICATIONS OF ANALYTICS IN CONSUMER FINANCIAL SERVICES

The primary application of analytics in consumer financial services relates to credit risk scoring. Credit scoring techniques assess the credit risk of lending to a specific consumer. Credit scores are used in deciding whether to grant credit to a consumer applying for credit, how much credit to grant and at what interest rate. It is also used in managing existing customer relationships. For example credit scoring is used in determining whether to increase or decrease an existing customer's credit limit or allowing a customer to charge certain

amounts above their credit limit. It is common practice to periodically review an existing customer's credit quality through behavior scoring to determine whether to increase or decrease the credit limit and adjust the interest rate charged to cover any change in credit risk. When it comes to managing collection of delinquent accounts and recovery of charged-off loans, credit scoring also plays a crucial role in the prioritization of collection accounts to maximize the collectors' productivity.

Overall, despite the recent catastrophic failures in risk management related to consumer mortgage loans in the United States, the advancement of analytical applications in consumer credit businesses is no doubt one of most significant developments in modern finance. It greatly increased productivity of the financial services industry, which in turn helped increase the overall living standard by making consumer credit available and affordable to large sections of the population. In that sense the wide spread application of analytics helped make consumer credit into a mass product from a privilege only available to the elite.

Several reasons explain why analytics as exemplified by credit scoring achieved such tremendous success in consumer financial services and became so well accepted over the past 50 years:

1. Development of a large-scale consumer credit market in the post World War II years in the United States demanded a low-cost and efficient way to assess a consumer's credit risk. The emergence of small, evolving credit products meant the industry needed to replace expensive and labor-intensive manual evaluations by credit reviewers. The advancement in statistical modeling techniques and computers made this feasible.
2. Market competition also played a large part in popularizing the applications of automated credit evaluation based on statistically derived credit scoring models. Once the success of such an approach was established by a consumer credit operator, the competitive edge it created quickly forced other industry players to adopt similar practices, thus making credit scoring quickly accepted and pervasive in consumer financial services. As one innovative application led to another, credit scoring practices quickly spread from granting credit applications to management of the whole credit lifecycle.
3. Credit performance of consumers is fairly predictable in a statistical

sense. After all, in the absence of intimate knowledge about a person's character and his or her circumstances, the best prediction of a person's future fulfillment of a contractual obligation of paying back loans is his or her past credit behavior, especially their history of payments and personal finance management. This is why metrics such as percentage of times past loans have been satisfactorily paid back, number of historic delinquencies and severity of delinquency, length of credit history, as well as utilization rate of available credit, are important and effective predictors of future credit performance.

4. Credit bureaus made credit information widely available to consumer financial service providers. This factor cannot be emphasized enough. The availability of consumer credit data (contributed and shared by all major consumer credit industry players) made statistical evaluations of a consumer's credit quality possible based on a complete history of the person's financial record. It is no coincidence that countries such as the United States and United Kingdom – that have the most balanced legislation on consumers' need for information privacy and the credit industry's need for shared consumer credit history – also have the most advanced application of consumer credit analytics.

Today, the application of analytics in consumer financial services extends well beyond assessing consumer credit quality at the time of acquisition to maximizing overall business profitability by optimizing a series of business decisions through the customer lifecycle.

APPLICATION OF ANALYTICS IN CONSUMER RETAIL MARKETING

Analytics is certainly no stranger to consumer retail marketing. There are pockets of successful application of analytics in marketing. For example, in direct mail or telemarketing a standard practice is to apply statistical models to select consumers for targeting to maximize response rate or profit. Market research is another area that relies extensively on analytics for complex sample design and hypothesis testing. The practice of consumer segmentation has also advanced significantly with the increased availability of sophisticated statistical analysis techniques.

Other applications in marketing that have seen considerable thought leadership and forward thinking in recent years include:

- sales forecasts and driver decomposition models,
- micro market planning leveraging geospatial analysis,
- pricing optimization based on consumer elasticity estimates, and
- experimental designs accelerating organizational test and learn.

The rest of this article briefly discusses analytic frameworks in these emerging areas, their potential to have significant business impact, and the challenges they have in being widely adopted and relied upon as a standard practice for ongoing business decision-making. This doesn't represent an exhaustive overview of all such marketing applications or the implementation issues involved, but only the authors' personal experiences from many years of field practice across multiple business verticals.

▶ ***1. Sales forecasts and driver decomposition models.*** The most commonly used approaches to predict future sales and revenue in marketing rely on time series forecast or various smoothing methods. The time series forecast model most often employed is the ARIMA (Auto Regressive Integrated Moving Average) model. Smoothing methods include moving average, exponential and Holt-Winters triple parameter smoothing. The major advantage of time series or smoothing techniques is that they only use past sales or revenue data to forecast. And they are relatively simple to do with many built-in procedures and routines to choose from specialized software. However, these advantages have to be balanced against their shortcomings. First they don't provide a very reliable forecast when the forecast goes very far into the future. Second and more seriously they don't allow incorporation of various known factors that impact sales and revenues, such as marketing campaigns or price promotions.

Often marketing executives are challenged with explaining why the forecasted sales or revenue fell short of (or performed better than) the plan. What factors, internal or external, contributed to the difference? By how much? And therefore how do we plan better and allocate resources smarter going forward? Time series or smoothing methods will not be able to answer these sorts of questions. Business driver decomposition based on sophisticated marketing mix models is increasingly becoming a strategic tool for expert marketers to further organizational thinking around short-term versus long-term growth accelerators in the business. Mix models allow for controllable internal factors such as marketing, distribution, price, promotion, loyalty, etc. to be modeled concurrently with uncontrollable external factors such as seasonality, macro-economic trend, competitive activity, etc.

Incorporating a Bayesian component within this framework provides the model foundation to be "evolutionary" in nature, i.e., the model can easily incorporate new information as new data or new business learning is captured. Optimization processes can further ensure that the best model result with the highest stability is generated incorporating prior known knowledge at any given point in time. A robust implementation of such an approach could enable business decision-makers to proactively do what-if scenario analysis (simulation) of possible outcomes under different combination of business actions and external business environments.

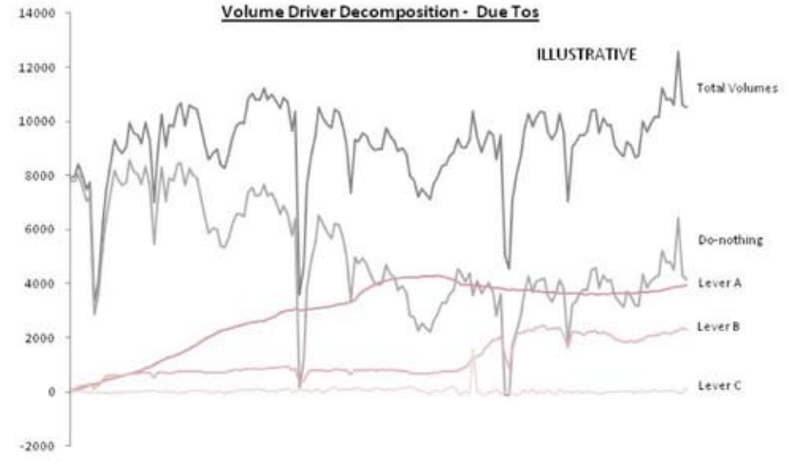


Figure 1: Volume driver decomposition.

▶ ***2. Micro market planning and geospatial analysis.*** Borrowing fundamental scoring principles from consumer credit risk applications, micro market planning is a methodology to forecast demand potential based on consumer geo-demographics, but at an aggregated unit of geography like Block Group or ZIP+4. In developed markets, the Census Bureau typically makes available detailed socio-demographic profiling data at a micro-geographic unit level. Other commercially available economic data in these markets

such as aggregated credit profiles and automobile ownership data can all be used in combination to predict local consumer demand and market potential.

Micro market planning models can be used to improve brand performance (share capture) at a local market level by optimizing distribution, pricing and marketing tactics. The framework involves:

- Understanding population characteristics that fundamentally drive demand for a brand,
- Objectively scoring the entire universe of micro-geographies in a country for potential revenue opportunity (demand volumetrics),
- Establishing how effectively the brand is currently capturing local market potential and if there is opportunity to improve resource allocation,
- Mapping the competitive landscape in each micro-market and assessing the strength of our relative value proposition,
- Identifying pockets to open new stores, activate localized pricing, improve grass-roots marketing actions, manage local retail outlet performance, etc.

In developed economies such as the United States, the United Kingdom, France, etc., the availability of rich sources of detailed demographic and socio-economic information at very refined geo-levels makes the rollout of micro market planning analytics quite easy and very successful. In emerging markets such as India, however, adoption faces many technical obstacles, as well as some cultural challenges. The availability of actionable external demographic data is often limited and the ability to acquire the data cost effectively in a user-friendly manner is difficult. Even more challenging is the ability to geo-code (rooftop address-based lat/long) distribution locations and customer addresses accurately given the underdeveloped postal systems in many parts of the world. The cultural bias ranges from simple lack of trust in statistical models to not believing any decision science based approach and reliance purely on one's gut feeling. However, this type of analytics has great potential to become more broadly used in the near future.

Our own experience of introducing this approach to the retail marketing arena shows that once you get past initial resistance in the field (often simply due to unfamiliarity with this type of scoring approach) and ensure that senior executives understand the robustness of the underlying methodology, micro market planning can become a strategic tool to optimize a series of local market decisions creating significant top-line growth. Great examples of such applications in retail would be in improving capital intensive decisions around store openings/closures and optimization decisions around targeting ads/flyers in field marketing.

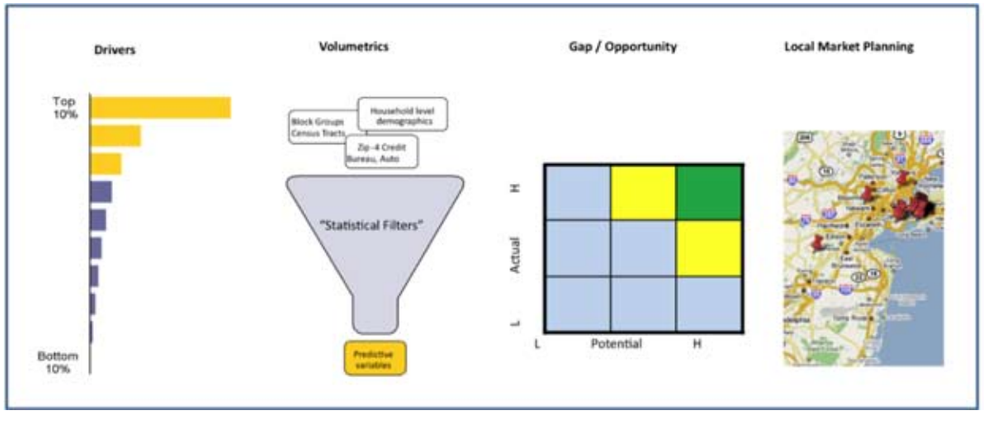


Figure 2: Micro market planning.

▶ ***3. Pricing optimization.*** The concept of price elasticity is certainly not new to marketers. However, other than its conceptual application during pricing discussions, the development of analytic consumer elasticity estimates is not widely practiced in the retail marketing arena. The main obstacle is that the development of such a model requires many price point changes within a carefully designed experiment. A reasonably robust price elasticity model also needs to include data on competition and customer disposable income, both of which are hard to come by. However it is still possible to develop price elasticity models with limited price ranges and narrow customer segments to optimize decisions.

Companies can expect to increase the ROI on pricing decisions and substantially improve margins, provided they are willing to invest time and resources in building the foundational analytic infrastructure needed to develop and continuously refine consumer elasticity models. A good starting point would be creating a historical database with detailed information on all past pricing actions. All relevant data pertaining to a price change such as duration (temporary vs. permanent), geography (national vs. regional), product (core vs. substitute), discount (promotion vs. base price), extent of price change (percent drop), etc. would be key inputs to the elasticity model.

Information on market conditions such as overall trajectory of the economy, trend

in relative share, etc. would need to be well understood and accounted for in the price elasticity model. Competitive intelligence information related to competitor prices, marketing activities, new entrants and emerging alternatives will impact consumer response and therefore need to be introduced in the model as well. Armed with the right set of data, specialized software packages can test a series of econometrics models that best capture the time effects and cross-sectional effects of price change, while controlling for other intervening factors. Deploying a simulation tool that leverages these complex elasticity estimates in the background helps company executives and line managers perform simple what-if scenario analyses to determine the best path of action with the pricing decision. In many instances, a range of possible outcomes exists; we could grow volumes or increase revenues or try to do both. An optimized price recommendation can be derived from the simulation based on observed/expected consumer elasticity and real world business constraints.

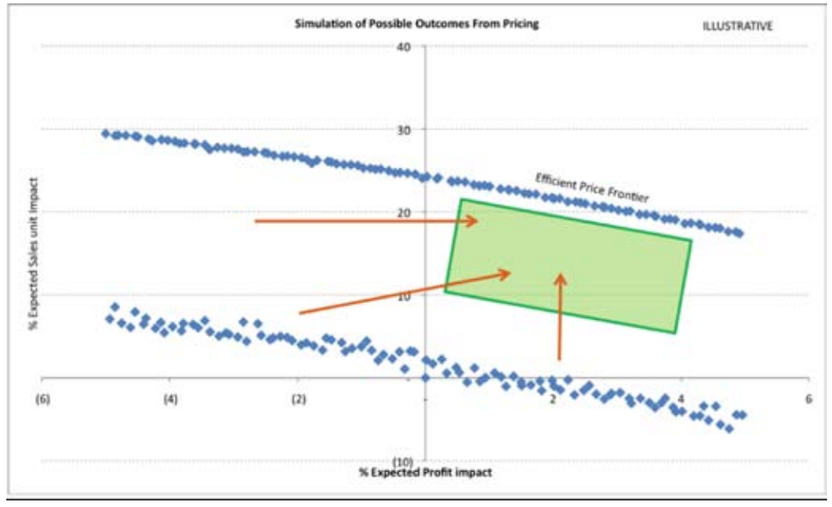


Figure 3: Simulation of possible outcomes from pricing.

In our experience, getting pricing optimization correct could easily lead to 50-100 bases points improvement in margins, especially in verticals such as retail with hi-lo promotion pricing models.

▶ ***4. Experimental designs.*** Without an effective learning and feedback mechanism, the basis for decision-making regresses to intuition. Reliable small-scale, in-market testing processes can help companies avoid costly mistakes and prevent strategic blunders with full-scale rollout. With the help of robust experimental designs, company executives can confidently measure the net impact of changing different levers impacting business concurrently. As data grows exponentially with technological advances and competition gets fiercer with globalization, a sophisticated "test & learn" capability is a must-have for companies seeking to gain competitive advantage from analytics in the long run.

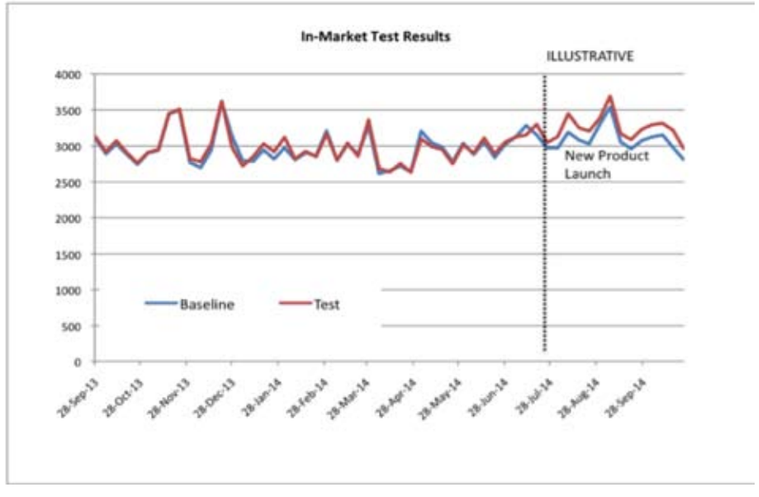


Figure 4: In-market test results.

No one software package currently covers all types of tests, and in most cases broader knowledge of statistics is still required for effective analysis and accurate interpretation. This is particularly true in the case for tests run at a geo-level compared to customer/account level. Geo-level tests use geographical areas or retail stores as unit of analysis instead of account or customer level. This implies sample size of geo-level tests is in general a lot smaller than account or customer level tests. In addition, geographical differences and dynamic localized competition further complicates impact measurement with geo-level tests.

In many instances, business runners focused on the need-for-speed test new ideas in selected geographies without setting up a robust test design (holdout group) upfront and statisticians are then asked to measure impact subsequently. The challenge in all these situations is: How do you separate treatment effects (impact of specific business initiative) from other uncontrollable effects; how do you confidently separate signal from noise and make an informed judgment?

Getting a stable and comparable baseline so that true treatment effects can be measured accurately and reliably is certainly not a trivial job. Theoretically speaking, given a test sample, if we can find baselines for test units and they are highly positively correlated, we can use paired sample T statistics instead of two independent sample T statistics so that T

Senior executives in retail marketing are beginning to embrace advanced decision sciences as a potential competitive advantage and differentiator in the marketplace. We are also beginning to see and expect a fundamental shift in the availability and access to consumer marketing data with the growth of the Web and e-commerce globally.

statistics from paired samples is greater than T statistics from two independent samples. Simulation results show a paired sample T test with a well-constructed baseline has higher power, smaller type I error and smaller Type II error. Of course, a tremendous amount of empirical research and simulation is required in order to find the right baselining rules that best fit your industry and brand situation.

Not surprising, in general, companies that have institutionalized test & learn processes have better performance over their peers.

CONCLUSIONS

The sophistication of analytics and deeper integration with business operations in consumer financial services is attributable to the successful application of credit-scoring techniques in managing customer credit lifecycles and availability of robust behavioral data through credit bureaus. The consumer credit industry benefited from the fact that credit risk management dominates the profitability of the industry and most decisions are structured at a customer level and therefore lend themselves to analytical approaches very well. In contrast, business problems in consumer retail marketing are less structured, often diverse and involve units of analysis much larger than individual customers. These problems require innovative approaches and out-of-the-box creativity to solve. Lack of actionable data for many retail-marketing problems has been a deterrent in the past. Scarcity of sophisticated analytic talent in the marketing function also contributed to the relatively slow progress over the years.

But all of that is beginning to change. Senior executives in retail marketing are beginning to embrace advanced decision sciences as a potential competitive advantage and differentiator in the marketplace. As seasoned practitioners of analytics, we are also beginning to see and expect a fundamental shift in the availability and access to consumer marketing data with the growth of the web and e-commerce globally.

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Soft skills: The 'killer app' for analytics

BY DAVID LEONHARDI

In today's turbocharged digitized world, there seems to be an "application" ("app") for almost everything. The intent of the app software is to help the user perform singular or multiple related specific tasks on a repetitive basis. In the field of analytics and decision analysis, the apps analogy can be made when we think about the entire list of "hard and soft" skills that are used when we are working to bring discipline and analytical rigor to business decision-making.

"Hard skill" apps can be classified as the left-brain technical skills and include analytical processes, procedures and techniques that are used to perform all forms of descriptive, prescriptive and predictive analytics. The "soft skill" apps can be classified as the right-brain interpersonal/personal skills that cover a large continuum of proficiencies such as communication skills, conflict resolution and negotiation, creative problem-solving, strategic thinking, team building, influencing skills and selling skills.

Like apps in the digital world, hard and soft skills are being used by practitioners in a myriad of combinations to satisfy the growing demand for analytical decision-making in a wide continuum of business situations. The success of today's decision analysts and analytical practitioners depends on the types of hard and soft skill apps in their toolboxes along with their abilities to creatively apply their apps to satisfy the needs of their customers.

Focusing on the acquisition of hard skills is easy since formal education and new analysis tools and training are readily available and are more tangible and easier to learn than soft skills (e.g., learning how to use a new simulation software package vs. learning how to be a better communicator). However, it is no longer sufficient to just bring a toolbox dominated by technical hard skills since they are becoming commonplace in today's business word. People are becoming more comfortable manipulating and analyzing information due to the pervasive use of spreadsheets and the availability of data. Microsoft gauges the number of Excel users worldwide at more than 400 million [1], and business data is being mined at an exponential rate and disseminated to managers who want to tap into that data and gain insights to make better decisions [2].

The second problem with this perspective is that the expectations of customers for analytic and decision analysis activities are changing. Customers are no longer looking for someone to simply do the number-crunching analysis. They are also looking for people who have the skills to effectively identify and frame a business opportunity or problem, manage a team to develop and analyze potential solutions, communicate insights and recommendations all while collaborating with the various stakeholders needed to make and implement the decisions associated with the business situation. The bottom line is customers are looking for a strong set of soft skills in addition to technical hard skills.

HARD SKILLS VS. SOFT SKILLS

All too often practitioners approach a situation from a technical solution viewpoint and frame the problem based on the hard skills they have in their toolbox verses using soft skills to investigate the dimensions of the business situation and tailoring their approach to match the organizational, analytical and content (data) complexities they are facing. This lack of soft skill usage can greatly impact the execution of projects and prove to be a barrier to adoption of decision analysis and analytics within organizations [3].

The one aspect that still needs to be addressed is the paradigm associated with integrating the two skill sets into a complementary offering that can be used to differentiate your work from other practitioners.

Fortunately, a growing recognition in the analytical community of the importance of soft skills, along with the complementary role that they play with technical hard skills, is leading to increased soft-skill competencies in practitioners. This year the spring INFORMS Conference on Business Analytics and Operations Research held its first dedicated soft skills track along with the Soft Skills Workshop. The soft skills track was the third highest attended track of the conference and the Soft Skills Workshop was sold out for the third year in a row.

Publications such as *Analytics Magazine* and business trade magazines are publishing more articles that focus on soft skills (for example, this is the second article this year covering in *Analytics Magazine* on the topic of soft skills [4]). Specialized soft skills training curriculums and course offerings that provide avenues for exposure to different soft skills have also become more prevalent. The one aspect that still needs to be addressed is the paradigm associated with integrating the two skill sets into a complementary offering that can be used to differentiate your work from other practitioners. This rest of this article offers a paradigm for turning soft skills into "The Killer App for Analytics" and how it can be incorporated into the products and services that you offer.

WHOLE NEW MINDSET

In 2005, Daniel Pink published a book titled "A Whole New Mind Moving from the Information Age to the Conceptual Age," a guide to "surviving, thriving and finding meaning in a world rocked by the outsourcing of jobs abroad and the computerization of our lives" [5]. I purchased this book based on its intriguing title with no intention of revamping the decision consulting services that I offer. But looking back over the past six years since reading the book, it has had one of the biggest impacts on the way I differentiate and deliver my services as an internal consultant at a large corporation.

The basic premise of "A Whole New Mind" is that the societal and economic forces of abundance, globalization/outsourcing and automation are causing a progression from the Information Age where "knowledge" workers are well-educated manipulators of information and deployers of expertise to a new age which Pink has labeled the "Conceptual Age," where workers have the aptitudes of "high concept" (the capacity to detect patterns and opportunities, combine seemingly unrelated ideas into something new and craft a satisfying narrative) and "high touch" (the ability to empathize with others, to understand the subtleties of human interaction and to stretch beyond the quotidian in pursuit of purpose and meaning [5]).

The implications of this societal shift on workers is that Information Age "left brain" capabilities found in knowledge workers are necessary but not sufficient, and that workers need to develop "right brain" capabilities to become *creators* and *empathizers, pattern recognizers* and *meaning makers* in the Conceptual Age. In order to navigate through the emerging landscape, six new abilities (design, story, symphony, empathy, play and meaning) will need to be mastered [5]. By intertwining these abilities with a rich toolbox of technical skills you can create a unique offering that addresses the needs of the business situation and that will increase the probability of success in executing your projects. The following are some examples of how you can deploy these new abilities in the execution of your projects:

▶***Not just function; it's also about the "design."*** *Functional products and services are no longer enough; you need to be able to design emotionally engaging products and services [5].* In an increasingly fast-paced business environment, executives and project team members have limited time, especially when a project is assigned in addition to regular responsibilities. This dynamic can make it

difficult to keep attention focused on execution of the project. To counteract these time pressures, facilitation and coaching techniques along with software applications can be combined to deploy rapid project framing workshops, creativity workshops for innovating different solutions for a given business situation, rapid decision-modeling workshops, decision dialogue facilitation and stake-holder coaching/education.

▶ ***Not just argument; it's also about the "story."*** *Despite all of the information and data, an effective argument is not enough. You need to have the ability to fashion a compelling narrative to convince and communicate [5].* One of the hardest things to do is create and present a compelling rational to gain commitment to action. Project teams have a tendency to work in isolation and get to the point of making a recommendation with a "big" report-out for the project that tells the "whole" story all at once. The problem with this is that the level of understanding achieved during the report-out may not be high enough to gain commitment to action. By facilitating an on-going dialogue throughout the life of the project between all of the stakeholders you can create a shared understanding as the project progresses, thereby increasing the probability of gaining commitment to action.

Two other elements that help in creating a compelling rational are value-based conversations and scenario formulation/analysis. You need to be able to address the values of the stakeholders (what objectives do they have, what risks are they trying to avoid) and how well the solutions brought forward deal with the values. Scenario formulation and analysis helps to test assumptions that are used and create insight around the robustness of the recommendations.

▶ ***Not just focus; it's also a "symphony."*** *What's in greatest demand today isn't analysis but synthesis. You need to see the big picture, integrate and synthesize to create something more than the sum of its parts [5].* One of the most important elements of a project is the communications between stakeholders and the project team, especially when initial insights can be communicated. By striving to gain a shared understanding of early insights, you can increase the chance of incubating hybrid solutions based on the desirable aspects of the different alternatives under consideration.

By including representation of the stakeholders affected by the solution early in the process, you have the opportunity to understand issues that can profoundly impact the outcome of your project along with building support for the implementation of the recommendations.

▶ ***Not just logic; it's also about "empathy."*** *In the world of ubiquitous information and advanced analytic tools, logic alone won't do. You need to understand others, forge relationships and care about others [5].* In the upfront stages of getting a project under way you need to think about what you are trying to accomplish and make sure to incorporate the appropriate stakeholders to increase your probability of success. It is easy to follow the strategy of developing a business solution and thinking that the implementation of the solution is something that will be dealt with at a later point in time. By including representation of the stakeholders affected by the solution early in the process, you have the opportunity to understand issues that can profoundly impact the outcome of your project along with building support for the implementation of the recommendations.

▶ ***Not just serious; it's also about "play."*** *Work and life is not all about being serious; you also need to have the ability to have fun [5].* The relationship that is created across a project team can make or break a project. As a project leader, you have the ability to build activities (e.g., team presentations, team executive interactions, recognition of contributions, celebrations of project completion) into the project execution to foster good relationships between team members and team ownership of the project. Try to gain an understanding of the personality types on the project team so you can anticipate the dynamics you may encounter and plan for any needs you may have to address.

▶ ***Not just accumulation; it's also about "meaning."*** *We live in a time of plenty. We need to pursue and satisfy more significant desires [5].* If executive decision-makers can make decisions based on a better understanding of the business situation's frame or the available alternatives – without the need for further analysis – analysis becomes accumulation without meaning. I have saved valuable time for executives and project teams on many occasions by simply asking the question, "Can you take action now?" By not taking the time to ask this simple question, we run the risk of alienating decision-makers by taking up more of their time with non-value added activities since they are ready to move on. Being flexible in project and process execution, having ongoing dialogues with stakeholders and asking if they have enough information to take action, can ensure that actions and analysis have meaning and impact.

In the long run, it will be interesting to see if we are indeed moving into the "Conceptual Age"; my belief is that we are. Within the company where I work, I see a growing demand for individuals with high concept/high touch skills in all aspects of the business. This is making soft skills a valuable component of any practitioner's toolbox and valuable in the execution of projects. The prepared practitioners will take an inventory of their soft skills and make a plan to nurture and grow their soft skill "abilities." The successful practitioners will turn these soft skills into the "killer app" for analytics and survive as we move into the Conceptual Age.

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Sports analytics, Part 2

The role of predictive analytics, organizational structures and information systems in professional sports.


BY BENJAMIN ALAMAR (LEFT)
AND VIJAY MEHROTRA (RIGHT)

Predictive models are a key component of every effective sports analytics program because these models translate raw data into useful information. For example, there is very little value in the motion capture data described in Part 1 without skilled analysis that transforms that data from millions of raw records into actionable information a decision-maker can understand and trust. Data sources alone are clearly unusable, as no decision-maker would be able to draw conclusions from these mountains of raw data. Once such data is analyzed, however, the analysis results have the potential to become a valuable and unique tool to aid decision-makers in making better decisions.

Teams often begin their use of predictive analytics because they are looking for a tool to reduce the seemingly high error rate in decision-making around their sport's amateur draft. Given the financial


BEYOND 'MONEYBALL'

The rapidly evolving world of sports analytics

The first of a three-part series defines and describes the current state of the field.

BY BENJAMIN ALAMAR (LEFT) AND VIJAY MEHROTRA (RIGHT)

Over the past few years, the world of sports has experienced an explosion in the use of analytics. In this three-part series, we reflect on the current state of sports analytics and consider what the future of sports analytics may look like.

We define sports analytics as "the management of structured historical data, the application of predictive analytic models that utilize that data, and the use of information systems to inform decision makers and enable them to help their organizations in gaining a competitive advantage on the field of play." Our definition is both expansive (in the sense that it includes not only statistical models but also the broader information value chain that surrounds these models) and restrictive (because it excludes traditional analytics applications such as demand forecasting, revenue management and financial modeling, all of which are certainly relevant in the business of professional sports). Our

Professional baseball and basketball teams are leading the pack of sports organizations that are embracing analytics.

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NOTE: *In Part 1 of this series, we defined sports analytics as "the management of structured historical data, the application of predictive analytic models that utilize that data, and the use of information systems to inform decision makers and enable them to help their organizations in gaining a competitive advantage on the field of play." We also looked at the increasingly diverse and sophisticated sources of data that in turn are driving explosive growth in the field of sports analytics. In Part 2, we examine the ways in which predictive models and information delivery systems are leveraging these growing mountains of data to create the types of competitive advantage that every team is after.*

investment and opportunity cost associated with high-round draft choices, teams that spend a draft pick on a player who does not make a significant contribution find they have made an expensive mistake. Conversely, drafting well can make a huge impact on a team's fortunes, sometimes immediately and often for several seasons to come.

Given these risks and opportunities, the draft is a place where teams have historically spent a lot of time and energy, helping open the door for predictive analytics. The draft also provides a fairly easy starting point for teams because much of the data used is publicly available, building the models does not require the time and attention from decision-makers, and the use of the results does not require buy-in anyone other than the top decision-maker.

In 2005 NBA draft, the Portland Trailblazers commissioned a company called Protrade Sports (since renamed Citizen Sports and acquired by Yahoo!) to create a predictive model for the draft using college data [1]. The model, a logistic regression, was developed with historical NCAA box score data, historical draft information and performance of former college players in the NBA. The output of the model was an estimated probability that the player would be a contributing player in the NBA. This analysis summarized 10 years of NBA drafts into a meaningful and useable measure of each player's prospects.

MORE DATA, MORE TECHNOLOGY

As the complexity of the data available grows, so do the techniques and skill required to create useful information from that data. Starting in 2006, SportVision began using motion capture technology to track the trajectory and speed of every pitch in Major League Baseball. This created a new and complex data stream for teams to analyze and question. Some teams had analysts on staff already that were capable of handling this type of data, but the Tampa Bay Rays realized that they did not and recruited a physics and math professor named Josh Kalk to, among other questions, analyze how pitchers' release points change for different pitches [2].

Recent years have seen an explosion in the use of information systems designed to support analysts and decision-makers in professional sports. These applications, including desktop and mobile software, as well as customized Web pages, can be thought of as interactive reporting systems. Such systems sometimes serve as

The Houston Rockets, Philadelphia Eagles and Cleveland Indians have all advertised for database programmers to work on the sport side of the organization. These teams, among many others, have been building the human resources needed to implement an information system capable of providing the organization with a competitive advantage.

a platform for delivering the results of predictive models and supporting "what if"-type analysis. However, to date their primary purpose has been to quickly deliver easily customized data summaries, often called "descriptive analytics." Thus, just as in the business world, these types of systems (typically desktop packages, interactive Web pages and mobile applications) present the world of professional sports with both opportunities and risks.

As the saying goes, "In the land of the blind, the one eyed man is king." With a powerful ability to summarize vast amounts of information and deliver the results of these summaries, information systems enable data to be proliferated in an "on-demand" manner quickly and cheaply. Over the last few years, teams such as the Houston Rockets, Philadelphia Eagles and Cleveland Indians have all advertised for database programmers to work on the sport side of the organization. These teams, among many others, have been building the human resources needed to implement an information system capable of providing the organization with a competitive advantage. The first goal of many of these systems is to simply put all of the organizations information in one place, so that decision-makers have more efficient access to the information that they need.

The New Orleans Saints took information systems to the next level, in part by utilizing the ICE System currently available from Stats Inc. on draft day. This system replaced the magnet boards that display the depth charts of every team in the league and eat up considerable human resources to construct and maintain. During the draft, the Saints had access to "virtual" magnet boards that allowed them to easily see every team and maintain a list of draftable players that was updated in real time. They also enjoyed instant access to a large set of information on every player in the league to aid them in efficiently evaluating potential trades. This system ensured that decision-makers had the information that they needed when they needed it, and that this information was accurate.

In addition, for organizations with proprietary data and the knowledge

to leverage it, their own customized systems can be seen as the key to capturing competitive advantage. For example, Daryl Morey, the general manager of the Houston Rockets, recently wrote that private data is what ultimately drives competitive advantage [3].

However, Morey is still something of an outlier in the world of sports: an MIT MBA with an undergraduate degree in computer science who has also invested in an army of analysts on staff to help him make sense of the data. It is easy to imagine less technically savvy sports executives who might see the data pumped out by information systems as a low-cost analytics "solution." But from our experience, rarely will data alone – no matter how quickly it is summarized and graphed – provide actionable new insights.

In fact, as we look at the world of sports today, there appears to be a profound dichotomy: despite a rapidly growing interest in applying analytics, an explosion in data, a plethora of companies peddling information delivery systems and making promises, the actual impact of analytics on the world of professional sports is still somewhat limited.

BIG MONEY, SMALL ANALYTICAL IMPACT

What makes this truly surprising is the sheer size of the professional sports industry. The National Football League is a $9 billion per year industry, and Major League Baseball reported revenues of $7 billion in 2010. Meanwhile, a financial dispute between the league and the players union has put the NBA's $3.8 billion dollar business at risk for the upcoming 2011-2012 season. Given the amount of money on the line in the world of professional sports, it is natural to wonder why analytics do not (or at least "not yet") play a more prominent role in the way decisions are made.

We believe that the most significant structural barrier to the growth of sports analytics is not only the absence of a clear doorway for teams to systematically get involved with this nascent field but also the lack a clear process for developing the skills needed to open that doorway and have an impact on the other side. That is, for most sports executives and for many would-be sports analytics professionals, it is simply not clear how to get started.

Sports executives face a daunting challenge with regards to analytics.

Today's professional sports world is filled with win-at-all-costs pressures, and given the increased availability of data and visibility of analytics, a lot of pressure is on executives to find a way to harness this potential source of competitive advantage. However, most decision-makers have little to no experience or training in the methods and tools of analytics, and as such are not well-equipped to evaluate the landscape of options.

Today's professional sports world is filled with win-at-all-costs pressures, and given the increased availability of data and visibility of analytics, a lot of pressure is on executives to find a way to harness this potential source of competitive advantage. However, most decision-makers have little to no experience or training in the methods and tools of analytics, and as such are not well-equipped to evaluate the landscape of options.

The result is that some organizations start small, at best thinking very incrementally about analytics and at worst simply adding a small amount of staff and/or software as window dressing. Meanwhile, other organizations have absolutely no idea of how to begin and thus simply do nothing.

Another related problem is the lack of a true talent pool for sports analytics professionals. Today, there are a handful of people who whose academic and/or business training has provided them with strong analytic skills, and their passion for sports has led them to attempt to bring their skills to professional sports. There are, however, a larger number of individuals who are passionate about sports and "know enough to be dangerous." That is, plenty of people have had enough statistics classes or have worked with Excel tables enough to be able to create analytic models. The models may not be well-formed or properly estimated as the purveyor of the model does not have the training needed or exposure to a larger set of tools that are needed, particularly as the data becomes more complex. Most decision-makers in sports do not have the training to identify the strengths and weaknesses of various modeling approaches. This information gap may cause them to opt for the cheapest solution without understanding the value that a more robust approach could deliver.

However, the good news is that there are signs of change, both for executives and analysts. Events such as the Sloan Sports Analytics Conference at MIT provide venues for executives to discuss what is happening in the field and to get a sense of what kinds of analyses, and results, are possible. In addition, for practitioners/researchers interested in the field, such events provide a chance to not only demonstrate their capabilities and findings, but also to learn about what types of real problems professional sports executives are wrestling with.

Meanwhile, a few universities, including Georgia Tech and the University of San Francisco, have begun to offer courses in sports analytics. These courses give students exposure to the kinds of real-world challenges that teams are facing and some sense of the concepts and to the types of tools that they must master to make a real contribution.

But there is still a long way to go.

In Part 3 of this series, we will look to the future, discussing the structures and institutions needed to provide potential analysts with the training that they need to build and grow a sports analytics program and to provide decision-makers with the knowledge and tools they need to implement and lead a strong sports analytics program.

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Picking airline seats

If you had a "special" ticket that you could trade for the boarding pass of your choice, what number would you want to have?

BY HARRISON SCHRAMM

This is the November/December edition of *Analytics Magazine*, and that means that many of us will be travelling with families – either our own for visiting distant relatives or traveling alone for business sprinkled amongst the family gatherings [1]. On many air carriers you get a ticket and go to your assigned seat, and you know when you buy your ticket what seat you will have and you have no way to influence who your neighbors are. This is different than other carriers, such as Southwest, where you line up in ticket rank order and sit wherever you like.

If you had a "special" ticket that you could trade for the boarding pass of your choice, what number would you want to have? We'll assume a full flight with 90 seats, arranged in 15 rows of six (three on each side of the aisle). Two factors determine the quality of a flight if you are flying alone: the seat you have and who you sit next to. Let's assume that I'm someone who likes to have conversations with fellow passengers about what they are reading. If I saw a passenger carrying a copy of *OR/MS Today* [2], I'd want to sit next to them. Likewise, if I saw another passenger carrying the newest selection from the "Teen Paranormal Romance" shelf [3], I would not want to sit with them.

Now, if you don't care about what the other passengers are reading because you don't talk on flights, then your only concern is seat choice; the ticket that gives you the most choice in your seat is the first one (and you can stop reading the rest of this article).

If, however, you are concerned both with your seat and who you sit with, then you may want a different approach. Let's think about boundary cases:

1. If you have the first ticket, then you will get your first choice in seats, but are at the mercy of the other passengers for who sits next to you. You have a 1/89 ≈ 1 percent chance (assuming you pick an aisle or window seat) of sitting next to the passenger reading *OR/MS Today*.
2. If you have the last ticket, you have no choice in seats and also no choice in who you sit next to. You have a 2/89 ≈ 2 percent (assuming that the last seat on the plane is a middle seat) chance of sitting next to the passenger reading *OR/MS Today*.

It is immediately counterintuitive that the last ticket may have a better chance of sitting next to the "best" passenger than the first ticket.

Now, this is the five-minute analyst, not the five-year dissertation. The problem posed here could lead to a mountain of applied probability. To avoid this, I'm going to make an enormous simplifying assumption [4]:

When passengers board the plane, they do not take a middle seat if others are available.

We have also (implicitly) assumed that all of the other passengers are traveling alone. If we can live with these assumptions, we can compute probabilities of sitting next to the best passenger by breaking the problem up as shown in Figure 1.

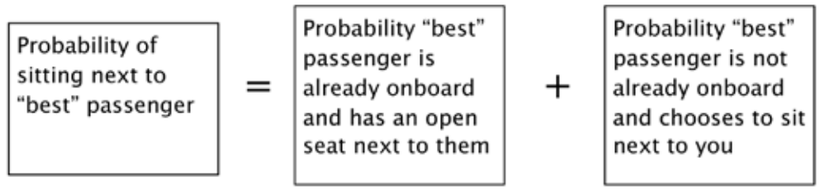

Figure 1: Schematic for computing probabilities under a simplifying assumption.

We can now think about "mixed" requirements – a person who wants to have a certain type of seat and also wants to sit next to the most desirable passenger, as depicted in Table 1.

Seat Preference	Required Ticket to Guarantee	Approximate odds of Sitting next to 'best' Passenger
Front row Aisle	2	2.2%
Window Seat or Aisle Seat	30	33%
Window or Aisle Seat	60	67%

Table 1: Number of ticket to guarantee seat type preference, along with odds of sitting next to "best" passenger.

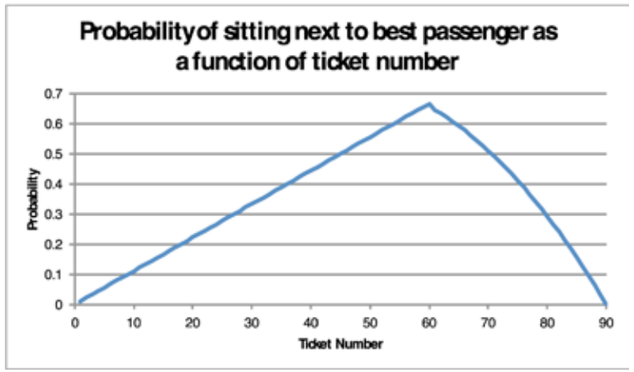

Figure 2: Probability of sitting next to best passenger as a function of ticket number. The probability increases near-linearly until the 60th ticket, at which time middle seats begin to be filled and it sharply decreases.

A graph as shown in Figure 2 may also be useful.

I've made a bunch of assumptions, and some of them are clearly unrealistic. So what was the point? The takeaway from this discussion is to see that there are circumstances where it is best NOT to be the first person on the plane. In particular, it would seem that (depending on assumptions) the best ticket to maximize both your seat choice and neighbor choice is probably somewhere between 30 and 60, or the middle boarding group.

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NOTES

1. In the interest of full disclosure I expect to do both.

2. *OR/MS Today* (www.orms-today.org/) is the membership magazine of the Institute for Operations Research and the Management Sciences (INFORMS), the publisher of *Analytics Magazine*.

3. Sadly, I didn't make this up.

4. If we didn't make this assumption, this would be a messy complication to the "Best Prize Problem" from applied probability.

Best host

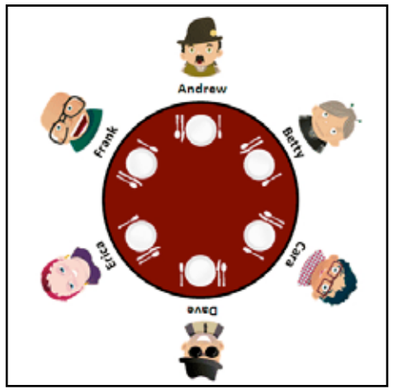

Figure 1: How can these six guests get along?

Hosting a dinner party requires several skills to pull off a successful evening. One of your duties, aside from preparing dinner and selecting the drinks, is to make sure your guests enjoy themselves.

Figure 1 shows a dinner table with six seats for your guests. Some guests, however, do not get along with each other. If two guests who do not get along are seated next to each other, it will create conflict at dinner. As host, you must arrange the guests in a seating order that minimizes conflict.

Andrew will only sit next to Dave and Frank; Betty will only sit next to Cara and Erica; Cara will only sit next to Betty and Frank; Dave will only sit next to Andrew and Erica; Erica will only sit next to Betty and Dave; Frank will only sit next to Andrew and Cara. In the example seating arrangement above, there are three conflicts (Andrew and Betty, Cara and Dave, Erica and Frank).

QUESTION:

What seating arrangement will minimize the conflict at dinner?

Send your answer to ThinkingAnalytics@gmail.com by Jan. 15, 2012. The winner, chosen randomly from the correct answers, will receive an "Analytics: Driving Better Business Decisions" T-shirt.

BY JOHN TOCZEK

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