

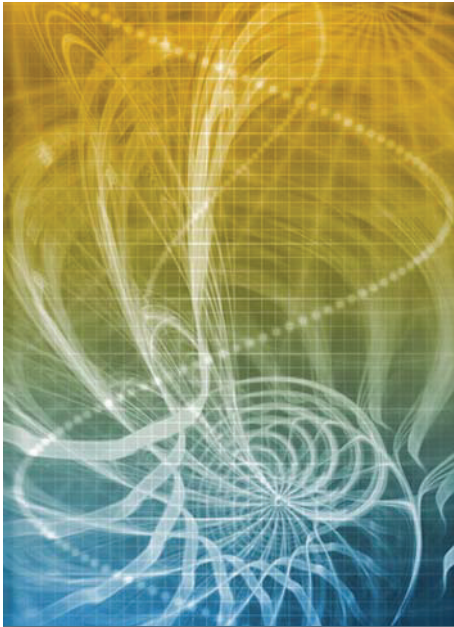
# Seven Reasons You Need Predictive Analytics Today

Predictive analytics has come of age as a core enterprise practice necessary to sustain competitive advantage.

**Eric Siegel, Ph.D.**  
Prediction Impact, Inc.

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**Predictive analytics:**  
*Business intelligence technology that produces a predictive score for each customer or other organizational element. Assigning these predictive scores is the job of a predictive model which has, in turn, been trained over your data.*

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With predictive analytics, the enterprise learns from its *cumulative experience* (data), and takes action to apply what's been learned.

*Predictive analytics has come of age as a core enterprise practice necessary to sustain competitive advantage. This technology enacts a wholly new phase of enterprise evolution by applying organizational learning, which empowers the business to grow by deploying a unique form of data-driven risk management across multiple fronts. This white paper reveals **seven strategic objectives** that can be attained to their full potential only by employing predictive analytics, namely **Compete, Grow, Enforce, Improve, Satisfy, Learn, and Act.***

**A New Phase of Enterprise Evolution:  
 Applied Organizational Learning**

Enterprise data is a priceless strategic asset because it represents the aggregate experience of an organization, the very history of its interactions with customers. Each customer response (or lack thereof), purchase decision, acquisition, outright defection, act of fraud, credit default, and complaint of a faulty product component provides the enterprise experience from which to learn.

Predictive analytics taps this rich vein of experience, mining it to automatically generate predictive models. Core analytical methods maximize model performance by tuning across *training data*. In this way, model generation is an act of *learning* from the experience encoded in data; the model itself is the deliverable that has been learned.

The enterprise realizes the potential business value of this learning process when it applies what's been learned. This is achieved by acting upon the score produced for each customer by a predictive model. For example, a churn model flags those customers most at risk by assigning them high predictive scores; targeting a retention offer such as a discount only to such customers provides a tremendous bottom-line win.

*Applied organizational learning* evolves the enterprise. This collective organizational process to learn from aggregate experience and apply what's been learned – across business functions – provides an unprecedented opportunity for growth. If your company intends to engage in this rapidly emerging phase of enterprise evolution, predictive analytics is the technology with which to do so.



Like insurance companies, all businesses would benefit from computing risk as a core process.

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Predictive analytics delivers a complete data-driven system for risk management.

## Managing Risk: What Every Organization Needs to Learn from Insurance Companies

The actuarial methods that enable an insurance company to conduct its core business perform the very same function as predictive models: Rating customers by the chance of positive or negative outcome. Predictive modeling improves on standard actuarial methods by incorporating additional analytical automation, and by generalizing to a broader set of customer variables. To leverage these advantages, many insurance companies are augmenting their practices by integrating predictive analytics in order to improve pricing and selection decisions (see Section 4).

Like insurance, all business is, at the core, an exercise in risk management. Every decision an organization makes, each step it takes, impacts the risks an enterprise must withstand, such as the risk of a customer defecting, of not responding to an expensive, glossy mailer, of consuming a retention discount even if she were not going to leave in the first place, of not being targeted for a telephone solicitation that would have landed a sale, of committing fraud, or of becoming a “loss customer” such as a bad debtor or an insurance policy-holder with high claims.

Therefore, like insurance companies, all businesses would benefit from measuring, tracking and computing risk as a core process. The data-driven means to compute risk – of any type of negative outcome in general – is predictive analytics. With customers ranked by level of risk, the enterprise may manage risk more precisely, effectively transforming risk into opportunity.

**Learn from your mistakes, analytically.** What the enterprise learns with predictive analytics is in fact *how to decrease risk*. Each negative outcome that occurs presents an opportunity from which to learn, systematically. To this end, the data from which predictive modeling learns includes the negative as well as the positive examples, both the successes and the inevitable “mistakes.” Each of these two kinds of experience provides important cases from which to learn. Even if the training data contains many more of one than the other – such as with direct mail, which often exhibits only a small percent of positive response – analytical methods can leverage 100% of the data in order to learn from all the outcomes an organization has experienced.



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With a tenured track record of success, predictive analytics boasts mature software solutions that deliver this technology to - and integrate it with - the modern enterprise.

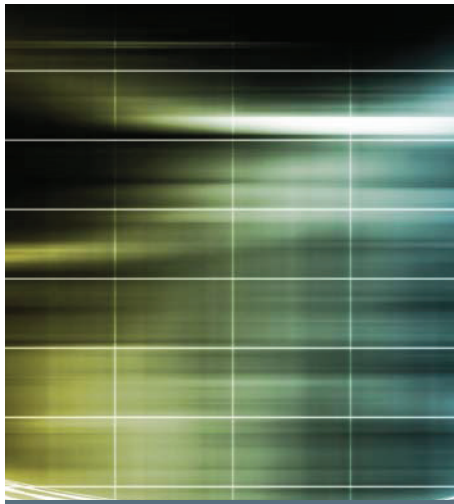
The enterprise integrates the predictive model’s scores in order to act upon what has been learned. At each step, the predictive scores foresee where a “blunder” may incur unnecessary risk, thereby guiding the organization to avoid it. In this way, predictive analytics delivers a complete data-driven system for risk management.

### The Age of Predictive Analytics: A Mature Industry

Predictive analytics has emerged as an established, pervasive business practice, as evidenced by the following:

**Proven analytical technology.** Born of research labs and built upon mathematics, probability, statistics, and database technologies, predictive modeling capabilities, known as *machine learning* in the academic arena, are scientifically proven and have benefited from decades of advancement. For more on this core technology, see Section 6.

**Established business value.** These research lab discoveries deliver in the “real world.” In one survey, 90% of respondents attained a positive ROI from their most successful deployment of predictive analytics; more than half from their *least* successful deployment.<sup>1</sup> In another survey, “Among respondents who have implemented predictive analytics, 66% say it provides ‘very high’ or ‘high’ business value.”<sup>2</sup> Predictive analytics initiatives show a median ROI of 145%, in comparison to non-predictive business intelligence initiatives' median ROI of 89%.<sup>3</sup> Another survey revealed, "Users of predictive analytics... have achieved a 1% improvement in operating profit margins over the last year, and a year over year increase in customer retention of 6%. Survey respondents that have not yet adopted predictive technologies experienced a 2% decline in profit margins, and a 1% drop in their customer retention rate."<sup>4</sup> With a tenured track record of success, predictive analytics boasts mature software solutions that deliver this technology to – and integrate it with – the modern enterprise.



Predictive analytics is full speed ahead, with an annual growth rate estimated at 8-10%.

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Your organization needs predictive analytics because these seven strategic objectives can be attained to their full potential only by employing it.

**Industry growth.** The race is on, and predictive analytics is full speed ahead, with an annual growth rate estimated at 8-10%.<sup>5</sup> In one survey, 85% of respondents have plans for a new deployment of predictive analytics within five years; 51.5% within six months.<sup>6</sup> In another, 79% of large companies have plans to deploy predictive analytics.<sup>7</sup> “Longer-term, the top objective for between two-thirds and three-quarters of executives is to develop the ability to model and predict behaviors to the point where individual decisions can be made in real time, based on the analysis at hand.”<sup>8</sup>

**Industry investments and acquisitions.** While numerous smaller analytics software vendors are founded, invested in and acquired annually, the most groundbreaking event on this front has been the IBM acquisition of SPSS for \$1.2 billion – an announcement made in the midst of the 2009 recession.<sup>9</sup>

**Industry events.** The growing popularity of established pure-play industry events focused on the commercial deployment of predictive analytics demonstrates the industry's traction and penetration. Such events include the cross-vendor conference Predictive Analytics World (<http://www.predictiveanalyticsworld.com>), and vendor-run events such as IBM Business Analytics Forum (<http://www-01.ibm.com/software/data/2010-conference/business-analytics/>). These event programs are filled with growing counts of brand name case studies and success stories.

### **Predictive Analytics Attains Strategic Objectives across Business Functions**

Applying predictive analytics across business functions, the enterprise achieves multiple strategic objectives. As shown in Figure 1, predictive models generated from enterprise data are integrated with business units across the organization, including marketing, sales, fraud detection, the call center and core business capacity (e.g., product assembly).

Your organization needs predictive analytics because the following strategic objectives can be attained to their full potential only by employing it. Each of these seven objectives is covered in the following seven sections of this white paper.

## Seven Reasons You Need Predictive Analytics — Key Strategic Objectives Attained:

*These strategic objectives can be attained to their full potential only by employing predictive analytics.*

1. **Compete** – Secure the Most Powerful and Unique Competitive Stronghold
2. **Grow** – Increase Sales and Retain Customers Competitively
3. **Enforce** – Maintain Business Integrity by Managing Fraud
4. **Improve** – Advance Your Core Business Capacity Competitively
5. **Satisfy** – Meet Today's Escalating Consumer Expectations
6. **Learn** – Employ Today's Most Advanced Analytics
7. **Act** – Render Business Intelligence and Analytics Truly Actionable

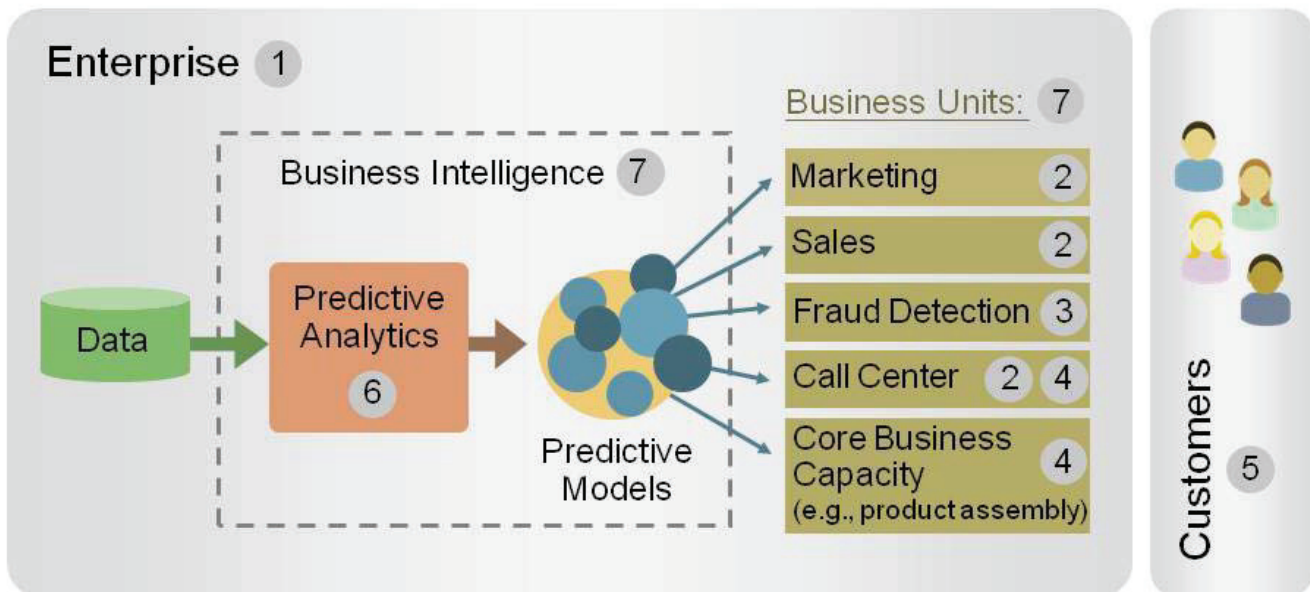


Figure 1. An enterprise deploying predictive analytics across business units. The circled digits 1 through 7 indicate where each strategic objective listed above is attained.

The top prospects flagged by a predictive model compose a customized, proprietary contact list.

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A predictive model distinguishes the microsegments of customers who choose your company from those who defer or defect to a competitor. In this way, your organization identifies exactly where your competitor falls short, its weaknesses.

## 1. Compete – Secure the Most Powerful and Unique Competitive Stronghold

*“At a time when companies in many industries offer similar products and use comparable technology, high-performance business processes are among the last remaining points of differentiation.”*

*Competing on Analytics: The New Science of Winning,*  
T. Davenport and J. Harris

As the products delivered by the enterprise – as well as those employed internally – become commoditized, competitive advantage hinges on improvements to business processes. Enter predictive analytics, the value proposition of which is to advance enterprise decisioning and operations with applied organizational learning. This learning process provides a unique competitive advantage and reveals competitor weaknesses. Survey results have shown a "tougher competitive environment" is by far the strongest reason organizations adopt predictive analytics.<sup>10</sup>

**The very sharpest competitive edge.** Predictive analytics delivers powerful, unique, qualitative differentiation by providing your enterprise a proprietary source of business intelligence with which to compete for sales and the retention of customers. A predictive model generated from your data taps into experience to which only your company is privy, since it is unique to your prospect list and to the product and marketing message to which your customers respond (both positively and negatively). Therefore, the model's intelligence and insights are outside the reaches of common knowledge, and the top prospects it flags compose a customized, proprietary contact list.

**Know competitor weaknesses before they do.** In contrast to broad trends that may be measured on a macro scale, a predictive model ekes out more refined buying patterns and trends in the form of customer *microsegments*. Since the data over which the model is trained includes your sales (and lack thereof) to customers who presumably are exposed not only to your own products and marketing, but also to those of your competitors, the modeling process

effectively learns to distinguish the microsegments of customers who choose your company from those who defer or defect to a competitor. In this way, your organization identifies exactly where your competitor falls short, its weaknesses, as discovered within the behavior trends encoded in your data. The enterprise then leverages this knowledge, acting upon these opportunities by way of precisely targeted marketing and sales activities.

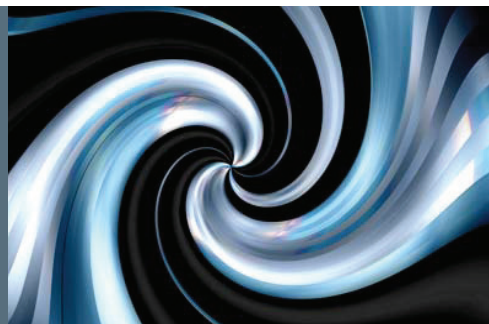
## 2. Grow – Increase Sales and Retain Customers Competitively

Marketing and sales applications of predictive analytics are its flagship value propositions, providing value uniformly across industry verticals. Each customer is predictively scored for sales-related behavior such as purchases, responses, churn and clicks. The scores then drive enterprise operations across marketing, sales, customer care and website behavior. In this way, predictive analytics delivers its unique competitive advantage to a range of customer-facing activity.

Predicting direct marketing response, the most established business application of predictive analytics, delivers tremendous return. The value proposition is straightforward. By suppressing those customers less likely to respond, costs are slashed, so profit goes up. If the 40% of customers identified as most likely to respond includes 80% of the total respondents, a good portion of the other 60% may be suppressed, which saves as much on campaign costs; the bottom line skyrockets. For example, First Tennessee Bank lowered its direct mailing costs by 20% and increased its customer response rate 3.1% by employing response modeling and other analytically-driven process improvements. More information about this and other case studies are available at <http://tinyurl.com/PAExamples>. For more detail on how predictive analytics works and how profit is improved, see the Information Management article, "[Predictive Analytics with Data Mining: How It Works](#)."<sup>11</sup>

Churn modeling may be the hottest business application of predictive analytics. While retaining customers is a top objective of many organizations, effective retention incentives, such as a discount offer, can be quite costly. The gain comes when such an offer is targeted only to those customers most likely to leave. With targeted retention, the growth rate of your customer base increases and compounds. For more detail, see the BeyeNETWORK article, "[Six Ways to Lower Costs with Predictive Analytics](#),"<sup>12</sup> and the Information Management article, "[Predictive Analytics' Killer App: Retaining New Customers](#)."<sup>13</sup>

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Predictive analytics also serves to slash expenses.

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 Scoring and ranking transactions with a predictive model dramatically boosts fraud detection.

**More applications.** Sales and marketing applications of predictive analytics also include *scoring leads* to target sales resources, *product recommendations* to increase cross-sell, *behavior-based targeting* to maximize online advertisement clicks, *market research survey analysis*, *scoring sales channels* and other B2B applications, *triaging collections*, *email targeting*, *increased fundraising profit* by scoring donors, and *targeting higher lifetime value (LTV) customers* for acquisition, upsell and high-tier customer care.

For more information on how various business applications of predictive analytics deliver value, see the BeyeNETWORK article, "[Predictive Analytics Delivers Value Across Business Applications](#)"<sup>14</sup>

**Cut costs.** Predictive analytics also serves to slash expenses. Many of the applications listed above may be positioned to this end, e.g., decreasing campaign spend by predicting non-respondents or withholding retention offers from customers who are going to stick around anyway. For more information, see the BeyeNETWORK article, "[Six Ways to Lower Costs with Predictive Analytics](#)."<sup>15</sup>

### 3. Enforce – Maintain Business Integrity by Managing Fraud

As transactions become increasingly numerous and automated, criminal opportunities abound. Across industry verticals, fraudulent transactions involving invoices, credit card purchases, tax returns, insurance claims, mobile phone calls, online ad clicks and consumer banking checks incur great cost.

Scoring and ranking transactions with a predictive model leverages the organization’s recorded experience with fraud to dramatically boost fraud detection. Since a team of investigators can inspect only a fixed number of suspected transactions each week, delivering a more precisely identified pool of candidate transactions – with fewer “false alarms” (*false positives*) – renders their time more effectively spent; more fraud is detected, and more losses are prevented or recouped. For example, automobile insurance claims fraud detection has delivered as much as 6.5 times the fraud detection capacity of that attained with no means to rank or score insurance claims.



Prediction plays a key role in advancing core business capacity.

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Predictive analytics improves product manufacturing, testing and repair.

In a similar manner, predictive analytics extends also to information security with the detection of online intrusions by hackers and viruses, as well as to the identification of criminals by law enforcement.

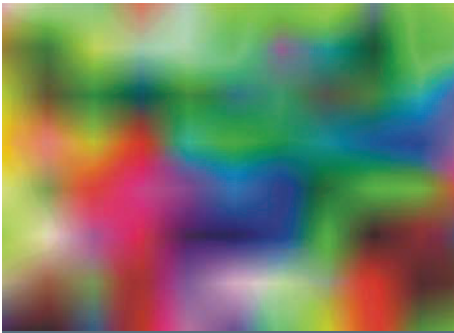
#### **4. Improve – Advance Your Core Business Capacity Competitively**

After growing sales and enforcing the integrity of business transactions, there is one remaining frontier for predictive analytics: improving the enterprise product and the efficiency with which it is produced. Whether manufacturing products or providing service offerings, the enterprise's central function is to produce and deliver with increasing effectiveness. To this end, prediction plays a key role in advancing core business capacity.

In the insurance industry, as discussed in the Section, “Managing Risk,” the value and competitive position of the enterprise products – insurance policies – hinge on predictive scoring according to risk. By more precisely identifying applicants with a greater risk of submitting higher aggregate claims, insurance providers can more effectively drive selection and pricing decisions in order to minimize loss ratio.<sup>16</sup>

Creditors such as banks similarly manage risk by predicting it, scoring loan and credit card applicants according to their likelihood of eventually defaulting on payments.

Predictive analytics improves product manufacturing, testing and repair in many ways. During production, faulty items are detected on the assembly line. Once products are in the field, *reliability modeling* determines which components are likely to fail or, in response to customer calls, which are likely to require repair, so they may be loaded onto a dispatched vehicle. In responding to calls regarding automobile repair, one roadside service provider improved its decisions as to whether a service vehicle needs to be dispatched at all.



Predictive analytics also advances central enterprise functions for supply chain optimization, HR decisions, political constituent scoring for political campaign optimization, and more.

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With predictive analytics, the consumer gets better stuff for less, more easily and more reliably.

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Predictive analytics is an explicit selling point to the end consumer: “[Firm] predicts these will be of interest to you.”

**A virtually boundless incoming wave of new “killer apps.”**

New innovations continue to expand the range of predictive analytics applications, improving core capacity and advancing central enterprise functions across classes of business. Additional examples include *supply chain optimization* with inventory demand prediction, *application processing* by predicting approvals and denials, *human resource performance* and attrition modeling to support decisions in recruitment, hiring and human capital retention, *proactive healthcare marketing* by predicting health risk, *algorithmic (black box) trading* by predicting markets, and *political constituent scoring* such as predicting likely or swing voters for political campaign optimization. Moving further afield to engineering, science, medical diagnosis and pharmaceutical (drug discovery) applications, many of the same core analytical techniques are employed, although the term *predictive analytics* is usually reserved for business applications.

**5. Satisfy – Meet Today's Escalating Consumer Expectations**

For more than a decade, it’s been said that the customer experience is the “next competitive battleground.”<sup>17</sup> Providing the sharpest of competitive edges, predictive analytics is the means with which to hold this ground. The advantages delivered to the enterprise discussed so far in this white paper entail a fortunate “flip side” – benefits to the consumer, who gets better stuff for less, more easily and more reliably:

**I. Greater relevancy, by way of more precisely targeted marketing.** Consumers will always demand a greater degree of relevancy. “Junk mail” and SPAM are decreasingly tolerated as time goes by. Product recommendations become increasingly visible, valued and even expected. Predictive analytics is an explicit selling point to the end consumer, as in the subject line of a well-known e-commerce website’s product recommendation email campaign, “[Firm name] predicts these will be of interest to you.”<sup>18</sup>

**II. Better products and services, by way of improved core business capacity.** Improvements delivered by analytical quality control, reliability modeling, streamlined services and expedited application processing meet the escalating demands of the consumer. End consumers and B2B corporate



“Art” enables predictive analytics to work; science proves it works.

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**Further reading:**  
 For an accessible introduction to how this core technology works, see: [“Predictive Analytics with Data Mining: How It Works”](#)<sup>19</sup>

clients alike will always trend towards greater awareness, agility and discriminating taste. The choice of vendors, products and service options grows, and customers are empowered with complete knowledge, as delivered online.

**III. Improved transaction integrity, by way of fraud detection.**

While fraud levels increase, consumers remain expectant of protection, yet become increasingly sensitive to the inconvenience of “false alarm” fraud warnings that interrupt payment transaction processing.

**IV. Cheaper prices, by way of greater efficiency.** With a competitive stronghold secured, success breeds success. Enterprise growth introduces new economies of scale, within the execution of predictive analytics itself, as well as business productivity in general.

**6. Learn – Employ Today's Most Advanced Analytics**

Standard business intelligence and reporting methods provide value in their capacity to summarize the past. Business reporting techniques, including scorecards, dashboards, KPI metrics, OLAP, ad hoc queries and standard marketing segmentation such as RFM, deliver a *retrospective* analysis.

The capacity for predictive analytics to learn from experience is what renders this technology predictive, distinguishing it from other business intelligence and analytics techniques. Predictive modeling is uniquely designed to optimize for the prediction goal at hand, such as customer churn. This optimization process is an act of learning since, to succeed, it must draw generalizations from data in the form of mathematical trends and patterns, and these generalizations must bear out when applied to unseen, forthcoming examples. Deriving a robust predictive model from the organization's data is the very act of learning from experience.

Art comes before science in this “magical” ability to generalize from examples. Even if there's plenty of data, with millions or billions of records, the design of a method by which the machine can generalize, finding patterns that hold not only in the data at hand but in general (a.k.a., *induction*), relies on human intuition and ideas. Fortunately, science serves to render these ideas formal, and to measure how

effectively the resulting predictive model truly generalizes. “Art” enables it to work; science proves it works.

Established predictive analytics methods are adept and robust, producing predictive models that work. These methods include decision trees, logistic regression, Naïve Bayes and neural networks. For an accessible introduction to how this core technology works, see the Information Management article, “[Predictive Analytics with Data Mining: How It Works](#).”<sup>19</sup> For a technical survey of methods, see the [Handbook of Statistical Analysis and Data Mining Applications](#).<sup>20</sup> For an academic textbook with the complete probability and math: Machine Learning, by T. Mitchell (McGraw Hill, 1997).

**Integrating social data and text analytics.** Predictive analytics integrates and leverages powerful sources of data such as social data and unstructured text. One major telecom doubled churn model performance by integrating social data, since, if friends a subscriber calls change mobile operator, the subscriber is more likely to as well. Similarly, a major North American telecommunications company has shown that customers with a cancellation in their calling network are 600% more likely to cancel.<sup>21</sup> A major online university targets friends of current students, since these prospects are 320% more likely to enroll.<sup>22</sup> One Fortune 500 global technology company performed reliability modeling in order to predict which components should be loaded onto repair dispatch trucks by way of analyzing the textual data of customer care agent notes.<sup>23</sup> For an overview of text analytics, see, “[Text Analytics 2009: User Perspectives on Solutions and Providers](#).”<sup>24</sup>

## 7. Act – Render Business Intelligence and Analytics Truly Actionable

*“Knowing is not enough; we must act.”*

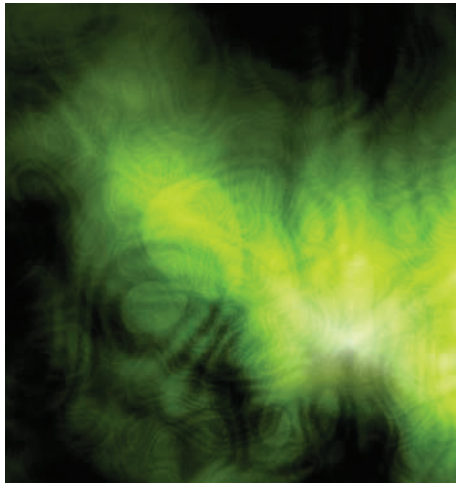
- Johann Wolfgang von Goethe

*“Value comes only when the insights gained from analysis are put to action to drive improved decisions. Best practice is to use decision management to embed predictive analytic models in operational systems.”*

- James Taylor, co-author of “Smart (Enough) Systems”<sup>25</sup>

The insights delivered by standard business intelligence and reporting are not readily actionable; they must be translated to action by way of human judgment. Metrics, reports, dashboards, and other retrospective analyses are important components of enterprise business intelligence, but their execution is ad hoc in that it is not clear a priori what kind of actions or decisions will be recommended, if any.

Predictive analytics is specifically designed to generate conclusive action imperatives.



Each customer's predictive score drives action to be taken with that customer. In this way, predictive analytics is by design the most actionable form of business intelligence.

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If business is a “numbers game,” predictive analytics is the way in which to play it.

In contrast, predictive analytics is specifically designed to generate conclusive action imperatives. Each customer's predictive score drives action to be taken with that customer. In this way, predictive analytics is by design the most actionable form of business intelligence.

**Drive decisions across the enterprise.** Predictive analytics delivers a powerful aggregate win by driving millions of operational decisions, such as whether to mail, call, offer a discount, recommend a product, show an ad or expend sales resources on a lead. For fraud management, the predictive model drives decisions to audit, investigate or block for fraud. And, in core business applications, analytically-driven decisions include whether to inspect an item or system for failure, load a component on a repair truck, dispatch assistance, provide a loan, fast-track an application or buy a stock.

For more on actionable analytics, see the DestinationCRM article, "[Driven with Business Expertise, Analytics Produces Actionable Predictions.](#)"<sup>26</sup>

**Gain strategic insights.** Predictive models tell you about your customers, revealing intent, preference and causation in their behavior. In addition to driving decisions with the scores it outputs, a predictive model delivers value in a second way: Inspecting the model's internal patterns or rules often reveals strategic insights. Although ad hoc in nature, such insights are a common benefit and provide targeted knowledge, since each predictive model is optimized for a specific prediction goal. For example, one churn model revealed that users with failed login attempts – possibly after forgetting their password – were at high risk for defection. This insight prompts an outreach program with password reminders, potentially saving on costly retention discounts such customers would otherwise receive based on predictive score alone. Model insights gained by a successful online social network identified key contributors to retention early-on, such as whether the user uploaded a photograph, leading to actions credited for doubling 1- and 2-week customer retention. One study showed better credit behavior among consumers whose purchasing indicates they err towards caution, such as the purchasing of certain products designed for physical safety.<sup>27</sup>

## Conclusions

Predictive analytics provides abundant opportunities for *enterprise evolution*. Even if your company already employs this technology, it presents such a wide range of value propositions, there will always be a new frontier on which to deploy it. Determine the next way in which your enterprise will evolve, systematically learning from organizational experience and applying what's been learned. If business is a “numbers game,” predictive analytics is the way in which to play it.

## Where to Learn More – Additional Resources

- **Training seminar:** *Predictive Analytics for Business, Marketing and Web*, a two-day intensive seminar brought to you by Prediction Impact, Inc. <http://www.businessprediction.com>
- **Online e-course:** *Predictive Analytics Applied*, immediate access, on demand at any time <http://www.predictionimpact.com/predictive-analytics-online-training.html>
- **Conference:** *Predictive Analytics World*, the international business-focused event for predictive analytics professionals, managers and commercial practitioners. Learn from industry leaders, expert practitioners, case studies and workshops. <http://www.predictiveanalyticsworld.com>
- **Online guide:** *The Predictive Analytics Guide*. Articles, portals and other resources. [http://www.predictiveanalyticsworld.com/predictive\\_analytics.php](http://www.predictiveanalyticsworld.com/predictive_analytics.php)

## About the author



**Eric Siegel, Ph.D.** is the president of Prediction Impact, Inc. (<http://www.predictionimpact.com>), and the conference chair of Predictive Analytics World (<http://pawcon.com>). An expert in predictive analytics and data mining, Dr. Siegel is a former computer science professor at Columbia University, where he won the engineering school award for teaching, including graduate-level courses in machine learning – the academic term for predictive modeling. After Columbia, Dr. Siegel co-founded two software companies for customer profiling and data mining, and then started Prediction Impact in 2003, providing predictive analytics services and training to mid-tier through Fortune 100 companies. Dr. Siegel is the instructor of the acclaimed training program, *Predictive Analytics for Business, Marketing and Web* (<http://businessprediction.com>), and its online version, *Predictive Analytics Applied*. He has published over 20 papers and articles in data mining research and computer science education.

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